Smithsonian

April 1993

VICTIM OF THE HOLOCAUST: Images from a new museum (p. 50)

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April 1993

Smithsonian

Volume 24, Number 1

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The Yaffa Eliach Shtetl Collection
United States Holocaust Memorial Museum

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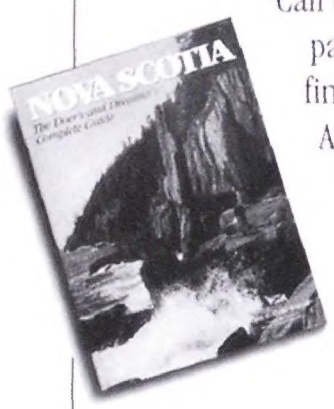

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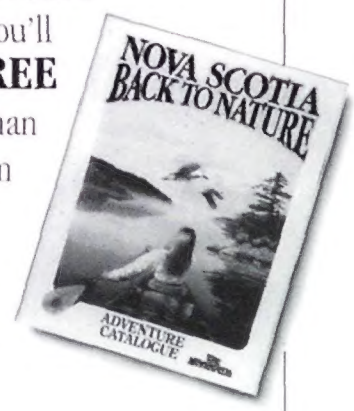

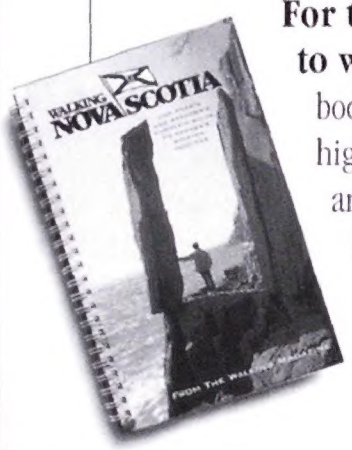

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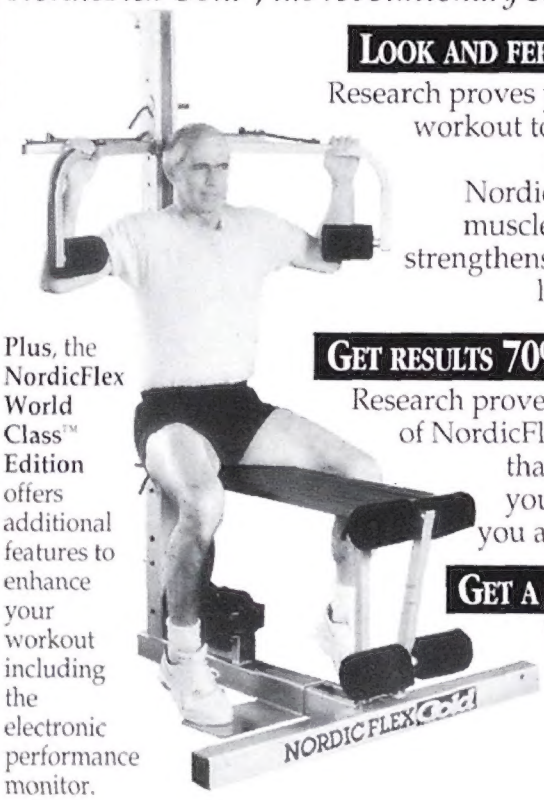

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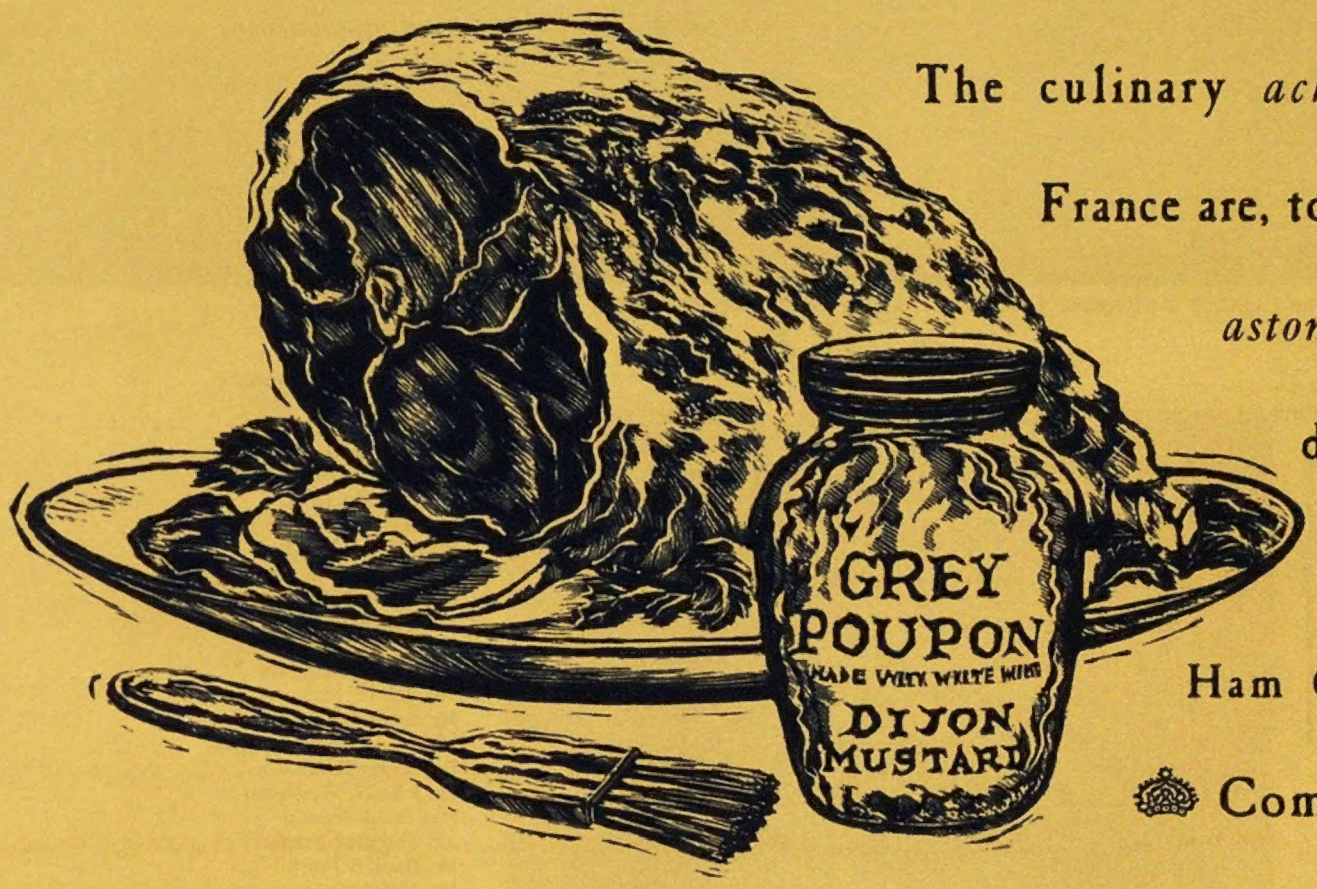

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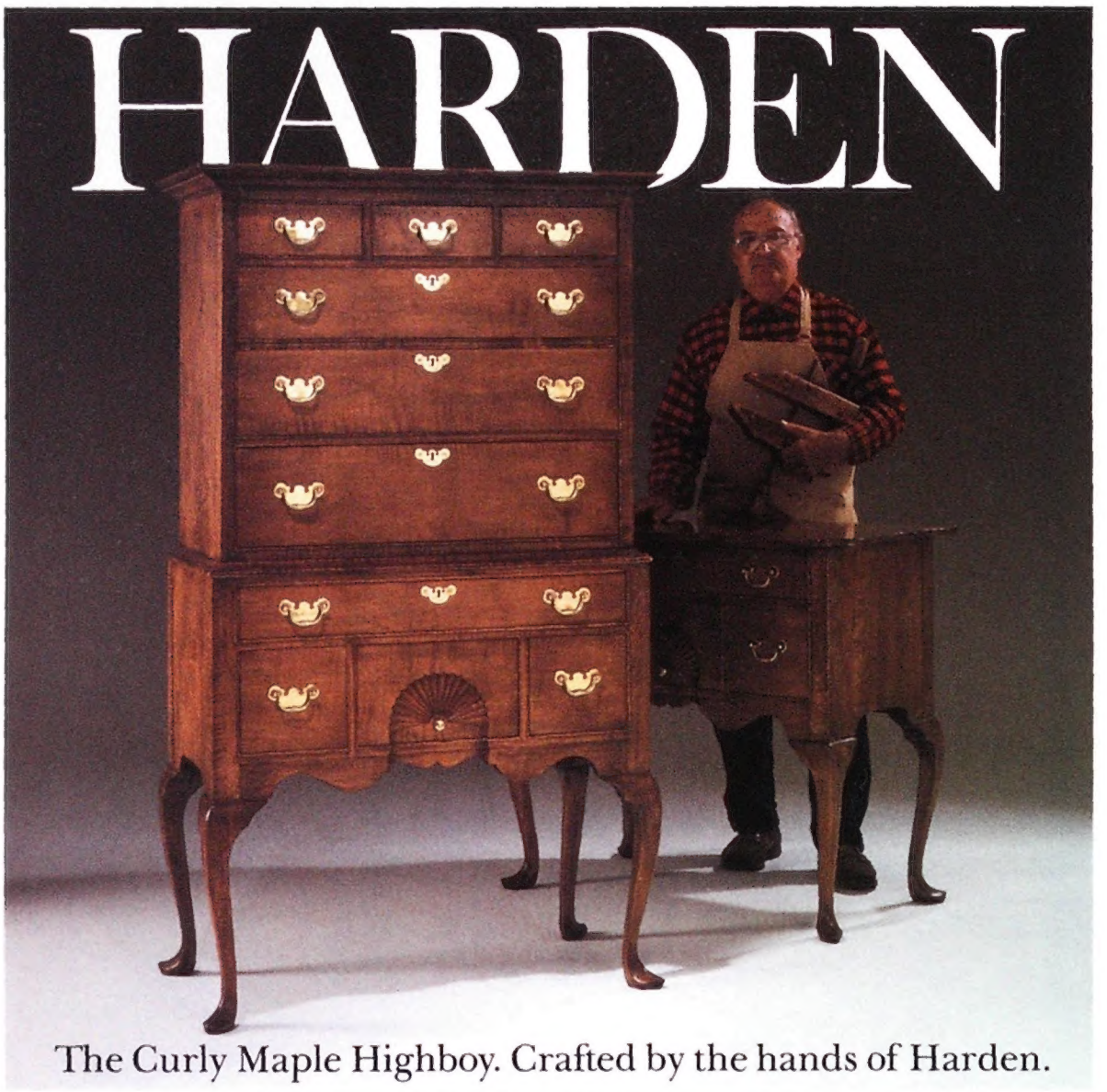

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Smithsonian horizons

Of progress made possible by computers, the growing network of communication will have the most significance for us

It is important not to confuse the current turmoil among computer manufacturers with a slowing of the industry's extraordinary rate of progress. In the view of an authority like John A. Armstrong, IBM's Vice President of Science and Technology, there is still "vast potential" for technological progress to continue. Improvements in performance, cost and reliability have varied from eightfold to thirtyfold per decade among its interconnecting, storing, switching and processing hardware components, "and the only reasonable, informed extrapolation is that each of these technologies will continue exponential improvement for another 10 to 20 years."

For more than two decades, miniaturization has been the dominant trend. By the beginning of the next century, Armstrong projects that a billion bytes of storage per square inch–100,000 pages of printed text–will be attainable. Beyond that, "engineering limits are like the horizon, you can't see beyond it, but if you struggle over to it, it will have receded." Digital optical computing is a particularly beckoning frontier, with improvements in performance of up to a few thousandfold in prospect for this decade. "Computers of the future, like communications networks, will be full of light."

The Smithsonian is like many other corporate and institutional users of computer technology. We still–but for how much longer?–employ mainframes for management functions like general ledger and related financial applications, and as a control point for electronic linkages with the outer world. Library and many collections information systems also reside on mainframes, with still-evolving software partly of our own design. Individual researchers, on the other hand, largely rely on their own microcomputers. Most of their computer-based communications are still limited to local area networks, although INTERNET, a worldwide network available to many academic institutions, offers great potential for electronic collaboration. What is in store for us as the explosive progress of the industry continues?

Clearly we must anticipate–and plan for–an awesome increase in the volume of intercommunication and in the part it plays in the daily conduct of our business. With huge increases in available bandwidth (hence content) for communications channels, and ongoing decreases in cost, Armstrong confidently foresees a time when everyone will be a user of the "system," and "all" systems will be interconnected. For many reasons (including limited discretionary capital), we're unlikely to be at the head of the line moving in that direction. But given our mandated responsibility for "the increase and diffusion of knowledge," we shouldn't allow ourselves to be very far behind.

Although the Smithsonian will welcome enhanced information storage and computing power, it is the ever deepening and widening network of communication that is likely to have the greatest significance for us. On the input side, it will encourage increasing use of on-line bibliographic databases. For me at least, nothing will ever completely replace the somewhat random process dignified as "shelf search" in great reference libraries, but computer terminals are already rapidly replacing library card catalogs. In some fields more rapidly than in others, curators will be able to let their fingers do the walking and call up the contents of current journals without leaving their desks. (A recent editorial in an academic newsletter rightly worries whether scholarly societies can survive when journal subscriptions disappear.)

Research collaboration is, of course, a two-way street. The density and importance of both incoming and outgoing messages, and the vitality and breadth of exchange they facilitate, can be expected to transform the publications in which our scholars and scientists participate.

Communication is not for specialists only. To reach the widest possible audience, we have begun to experiment with circulating electronic texts and images of our collections. Ultimately it is our goal to make these available to museums, libraries and schools all across this country. With more than 26 million individual visits to our museums last year, the Smithsonian already has an immense, unparalleled outreach. But real objects on exhibit, like their electronic images, seldom convey unambiguous, unchallengeable messages. Making them more and more widely available, we surely invite, and thus need to make provision for, a growing two-way flow of supplementary questions, suggestions and answers.

As John Armstrong himself recognizes, an attainable, hugely promising chain of technological possibilities does not necessarily lead to the realization of all foreseeable economic or social opportunities. Adequate cross-referencing between data, texts and facts still seems to lie behind an inelastic human horizon, in contrast to a receding engineering horizon. Legal disputation, differing manufacturing standards, and increasingly serious security and privacy issues will introduce delays, if not immovable obstacles. And government regulations notoriously take a slow and tortuous trail through forests of fiercely contending constituencies.

But the technological possibilities are awesome to contemplate. They will characterize the age to come. And the Smithsonian must take a creative part in finding uses for them.

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Letters to the Editor

American Indian Dance Theatre

Dear Sir: Barbara Schwei, Hanay Geiogamah and members of the company have done native Americans and the rest of us a real service in introducing to the world their American Indian Dance Theatre and its songs and dances, featured in your February issue.

I have enjoyed ethnic dancing from Bali to Brazil and Eastern Europe. None can compete with the display of color, drama and mutual respect for one another that I observed at my first powwow at Idaho's Fort Hall Indian Reservation last summer, ten miles from where I was born. But there was only token attendance by those who were not Indian.

We travel the world to see other cultures. After 500 years, maybe we will discover what has always been in our own backyards.

Marjorie McQuillan
Bothell, Washington

Dear Sir: From my childhood in the 1920s I have fond memories of American Indians coming to the Webster School in Everett, Massachusetts, each Thanksgiving season. Dressed in their traditional costumes, they would perform their ceremonial dances with their own sound effects, drums and voices. Lacking a school auditorium, we gathered in a hallway to watch in thrilled fascination.

Since then, Indians have always been a part of my Thanksgivings.

Barbara Jacobsen
Lynnfield, Massachusetts

Mississippi River

Dear Sir: I was born in and grew up in the Delta, and spend much time there visiting family and friends, and hunting, fishing and exploring the timberlands and oxbow lakes that border the river. Not once have I carried, or felt the need to carry, a handgun to protect myself from people who live in the Delta, although I might recommend that a stranger embarking on a raft down the river carry certain weapons against real dangers that might present themselves, such as snakes, wild boars, mosquitoes, ticks and the like.

Mr. Parfit's focus on racial conflicts and his exaggerated accounts of racism indicate to me that either he has a bone to pick, or he is oblivious to real life in the Delta, or he has fallen into the same rut as so many of our nation's journalists and writers, who feel compelled to focus only on matters they consider politically incorrect. I am disappointed that your article failed to capture the independent and unencumbered lifestyles of most of those living in rural parts of the Delta.

Thomas N. Rose
Little Rock, Arkansas

Dear Sir: Michael Parfit's article, "Downstream on the Mississippi," is a classic. Parfit wove the human and environmental currents of the great river into a riveting narrative.

Garth Sanders sr.
Redding, California

Dear Sir: Michael Parfit failed to point out the richness of the soil, which produces enormous crops of cotton, soybeans, rice and corn for our nation. He seemed to select the worst of the region's heritage, instead of writing an article that would encompass all aspects.

W. Van Cleve
Jackson, Mississippi

Dear Sir: My father was raised in Waterproof, Louisiana, which must have derived its optimistic name from its relatively high ground and very own stretch of Mississippi levee. In the early years of this century, Waterproof old-timers dismissed any high water by harking back to the flood of '82. But there was a later benchmark, as shown in this photograph of the Waterproof depot in the 1927 flood [below].

Dirk Ehlert
Seattle

Dear Sir: Tell Parfit to take a trip through ghettos of the Bronx, Queens, L.A. and other inner cities where life is rosier. Better a shotgun house than a virtually destroyed walk-up in the midst of crime, drugs and destitution.

Simone Brocato
Columbus, Georgia

Sutro Baths

Dear Sir: While in the Navy in World War II, I visited the Sutro Baths and was impressed by their museum collections and display of classical marble statuary.

After the 1966 fire the surviving collections and statuary were stored in nearby Cliff House, which had closed. I found out about their prospective sale through wild coincidence. A classmate of my teenage daughter's, offered anything she wanted for her birthday, asked to go to San Francisco for the weekend and take Patty. Patty saw a handbill of the sale and brought it home to me.

My wife and I flew up and were third in line on the morning of the sale. By 10 o'clock the line, in a drizzling rain, was two blocks long. Over my wife's mild, amused protests I bought all seven life-size marble statues. Later I sold four, but kept *Discus Thrower, Apollo* and *Diana the Huntress* and have enjoyed them every day. I can see them in the garden as I write this.

Ray Phillips
Studio City, California

Dear Sir: My husband was stationed at the San Francisco Naval Shipyard from September 1951 to September 1953. Living in San Francisco was one of the highlights of our lives, and among the many exciting things we did was swimming at Sutro Baths.

Mr. Jackson wrote that the swimming tanks were closed "right after World War II," but the "museum and rink hung on until early 1966." We watched the skaters and also went swimming in the tanks between 1951 and 1953.

Joan Lima Duncan
Portsmouth, Ohio

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This elegant Single Malt Scotch Whisky was distilled 21 years ago, since when it has been maturing in oak casks until its bottling in 1991.
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21

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REGENCY CRUISES

Ships' registry: Bahamas.

Dear Sir: The Sutro Library in San Francisco, which contains thousands of books on genealogy, is a genealogist's idea of heaven. I have spent many interesting and productive hours there, searching for my ancestors.
Ruth Martin
San Jose
Sutro's library was stored in two warehouses, only one of which burned in the 1906 fire. His heirs donated the surviving books to the State of California, and the library opened to the public in 1917. Rare books constitute 60 percent of the collection. However, the genealogical material, much of it donated by others, accounts for 90 percent of the library's use—and is the biggest such collection west of Salt Lake City. Ed.

Amazonia

Dear Sir: Shucks. You fellas need to come down to the Tennessee Aquarium in Chattanooga. We have a replica of the lake the Tennessee Valley Authority formed in the 1930s, called Nickajack Lake, that holds 138,000 gallons.

As tall as a 12-story building, the 130,000-square-foot aquarium traces the Tennessee River from its source high in the Appalachians to the Mississippi Delta. Over 4,000 living specimens of fish, birds, mammals, insects, reptiles and amphibians frolic or chew, or whatever they do, in natural surroundings.

In addition, the aquarium examines freshwaters of the world, from Africa to Siberia–yes, including the Amazon. The aim of this nonprofit, privately financed venture is to encourage an appreciation of a natural world that is tied together by moving water.
Ruth Smalley
Knoxville

Around the Mall and beyond

Dear Sir: "Chief Justice of the United States" is the correct title of that position, not "Chief Justice of the Supreme Court," as your article stated.
D. Parkhurst
Kankakee, Illinois

Flea markets

Dear Sir: Don't be so sure the washboard you bought as an antique wasn't made last month. Columbus Washboard Company has made them since 1895 and turns out from 150,000 to 175,000 a year.
Judith L. Preston
Springboro, Ohio

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The computer, appropriately enough, is called CLASS.

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And what CLASS demonstrates is how Sallie Mae uses modern technology to provide something that isn't modern or technological at all:

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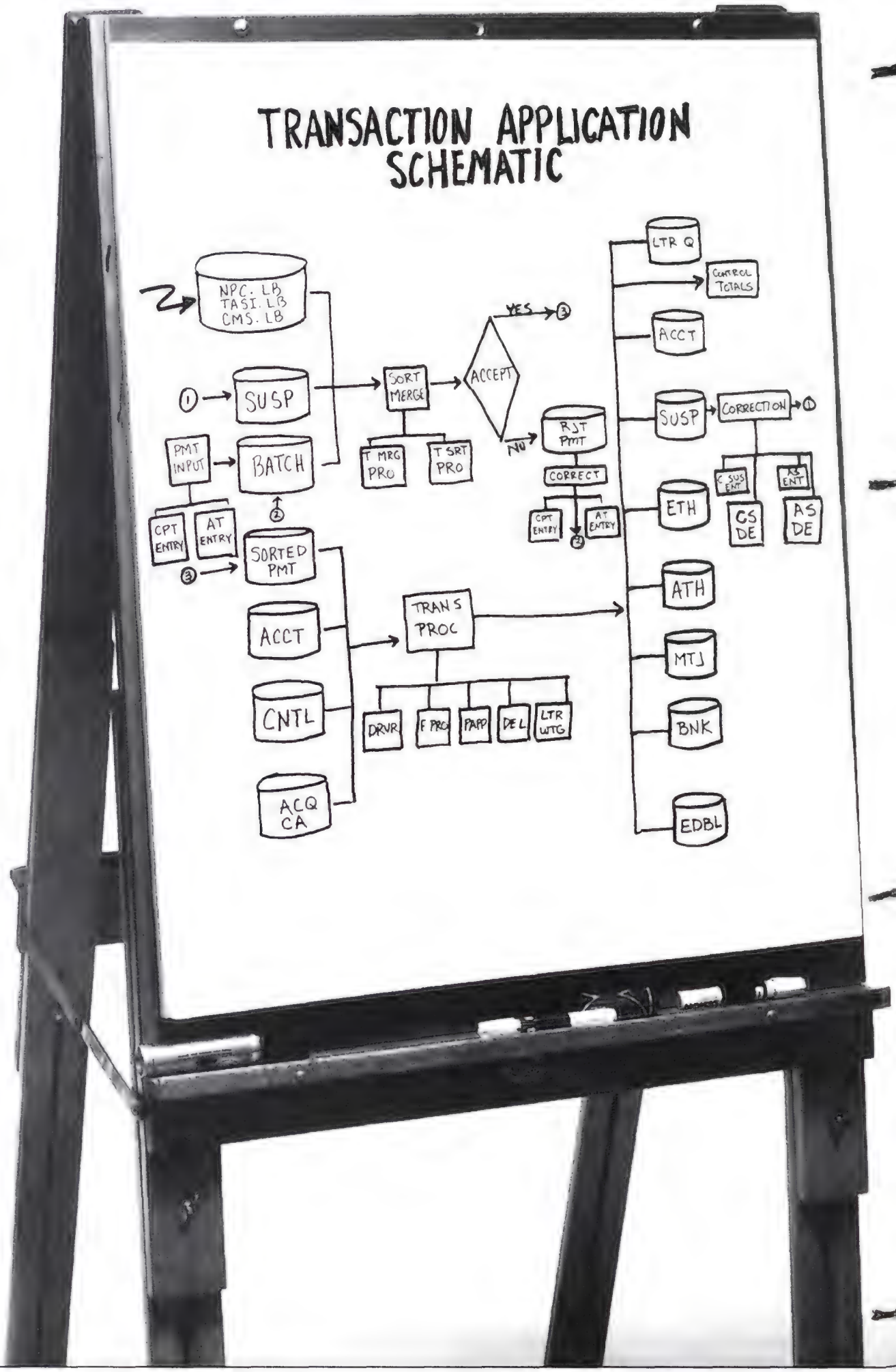
A CLASS ACT.

Strictly speaking, CLASS is not a computer. It's a highly integrated mainframe system that automates virtually every aspect of servicing student loans.

Every night it runs through our portfolio of 3.5 million student loan accounts looking for expiring deferments, loans entering repayment, past due balances, and loans nearing payoff. This nightly protocol tells us who to contact, and helps us spot situations that need our attention.



in customer service, minute of the first class of a four-year degree.

For example, if a borrower has missed a payment, CLASS will identify that borrower, dial his or her number, then route the call to a service representative who will help straighten the matter out.

CLASS frees our people from mundane tasks like looking up numbers and dialing phones, so they can concentrate on what they do best:

Talking to borrowers, answering their questions, and resolving their problems.

"THANK YOU FOR CALLING SALLIE MAE!"

With over half a million calls coming in each month, providing excellent customer service in an efficient manner is obviously a high priority.

Our philosophy here is simple. People don't want to be told someone will call them back. Or be asked to hold while someone looks up their file.

So when our phone rings, we answer it promptly, usually within ten seconds.

We can have a customer's complete borrowing history on the screen instantly.

And the people who are taking the calls know what they're doing.

Before they get on the phones our loan servicing personnel go through six weeks of training in which they learn the ins and outs of student loans.

Even then the training never stops. Once on the job they will spend 15% of their time back in the classroom, refining their skills, catching up on the latest round of regulatory changes, and learning even better ways to serve people.

Borrowers can also get instant access to simple account information by using our automated customer inquiry system. Day or night.

And let's not forget the mail. If you think our phone volume is heavy, you should see our mailbag.

We send out over four million pieces of mail a month, each piece addressing a particular borrower's situation. And when a customer sends a letter to us, we're usually able to respond within five days of receipt.

A GREATER RESPONSIBILITY.

Arguably, the most important service we provide, besides answering phones or questions, is called "debt management."

Many of our customers are students who are borrowing for the first time. With this loan they'll start building their credit history, so we want them to get off to a good start.

That's why we provide school financial aid officers with a wide variety of debt counseling materials which they can use with their students.

And that's why we've developed a number of innovative loan packages designed to make repayment easier, especially in the years immediately after graduation.

In fact, last year we introduced the Great Rewards℠ program, a new concept in student lending that lowers the interest rate for borrowers who make their payments on time.

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And that is just one of the ways we meet the expectations of the customers we serve and the private capital investors who invest in us.

Whatever America's future education finance needs will be, Sallie Mae will continue to focus the full power of private capital markets—and the very latest customer-oriented technology—on meeting them.

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Around the Mall and beyond

Glistening after a major renovation, the Library of Congress welcomes treasures from the Vatican Library

In 1989 this column noted that Robert Wernick, SMITHSONIAN's most frequent contributor, had come across with an amazing total of 50 articles for us (more than that, now). It was fun to recall them and look them up in back issues for reappreciation. And it inspired in me the idea of indulging in a memory piece when I came to my 200th *Around the Mall and beyond* column.

Typically, I forgot all about this wonderfully self-congratulatory plan, and my 200th column slipped right by without a single ruffle or flourish from me. Then I suffered a torn muscle in my thigh, and returned to the idea as a sneaky way of doing a column without dashing about fecklessly, as is my wont. So here is my nod toward 202 past columns.

It all started as a handy way for the magazine to cover the Institution yet still remain a publication of broader interests. Since the heart of the Institution beats on Washington's Mall, site of the Castle and nine museums, *Around the Mall* seemed a natural title. But I was assigned to write it as I was on my way to Australia and New Zealand with a Smithsonian Study Tour, so we added *and beyond*. Those two words gave access to research operations all over the world, and the column felt its way afield–to the Arctic, Panama, Arizona's Mount Hopkins, and a Caribbean cruise on the magnificent sailing ship *Sea Cloud*.

Small adventures cropped up in the search for columns: joining a bug-catching safari for the Insect Zoo; excavating mammoth bones from the mud of a construction site; helping tote Tanya, a seven-foot squid, from Massachusetts to the Museum of Natural History.

And the column has put me in the way of various notables: Walter Cronkite, Emperor Hirohito, Mopie the Gorilla, Dennis the Menace, Prince Charles, Fonzie, Sally Ride the astronaut, Nancy the Elephant, Gene Kelly the actor.

The first notable I interviewed, for *Mall* No. 1, in May 1975, was James Billington, then director of the Smithsonian's Wilson Center. He's now head of the Library of Congress, and I achieved another small chat with him last February. After being closed for three years, the Great Hall of the library's original building has at last been beautifully refurbished, and the "LC," as users call it, is celebrating the glorious face-lift with a break-through display: "Rome Reborn: the Vatican Library and Renaissance Culture."

This, says Billington, is the LC's first exhibit of treasures from one of its great foreign counterparts. The Vatican's collection of printed books and manuscripts is deemed the Western world's richest, and 200 of the best of them are at the LC until April 30. Visitors will get an eyeful, starting with a huge entrance foyer, the Great Hall, a splendid expression of a cherished architectural feature: the majestic block of empty space. People crossing its gleaming floor look small beside the arched walls and beneath the towering vaulted ceiling. Once they look upward at that ceiling they are spellbound and begin to collide, for the nearly forgotten paintings on those vaults, far overhead, have been freshly brightened and now glow with indirect lighting.

The refurbishing includes the LC's huge Main Reading Room and will extend to all the galleries that open from it on the second floor. It is in the newly finished Southwest Gallery–for years cluttered with lowered ceilings, partitions and gray government desks–and an adjoining pavilion that the Vatican Library's treasures are displayed.

"In the Middle Ages, Rome dwindled from about two million down to a sleepy little backwater town of maybe 20,000," said Declan Murphy, director of "Rome Reborn." "People hacked down great buildings and crushed the marble to get at the lime–for fertilizer."

Yet amid the chaos of the Dark Ages, precious manuscripts and maps were somehow saved, and in the growing enlightenment of the Renaissance, a couple of popes fashioned library rooms to preserve and study them. The collection grew from 3,500 items catalogued in 1481 to more than 2,000,000 today.

In 1928 the Vatican welcomed a group of American librarians who came to explain the Library of Congress system of cataloguing and to get the Vatican people started on sorting out their bewildering mass of treasures. It was because of that helping hand that the Vatican allowed Declan Murphy and a small team of scholars from the LC to prowl through its trove and come up with the items on display here.

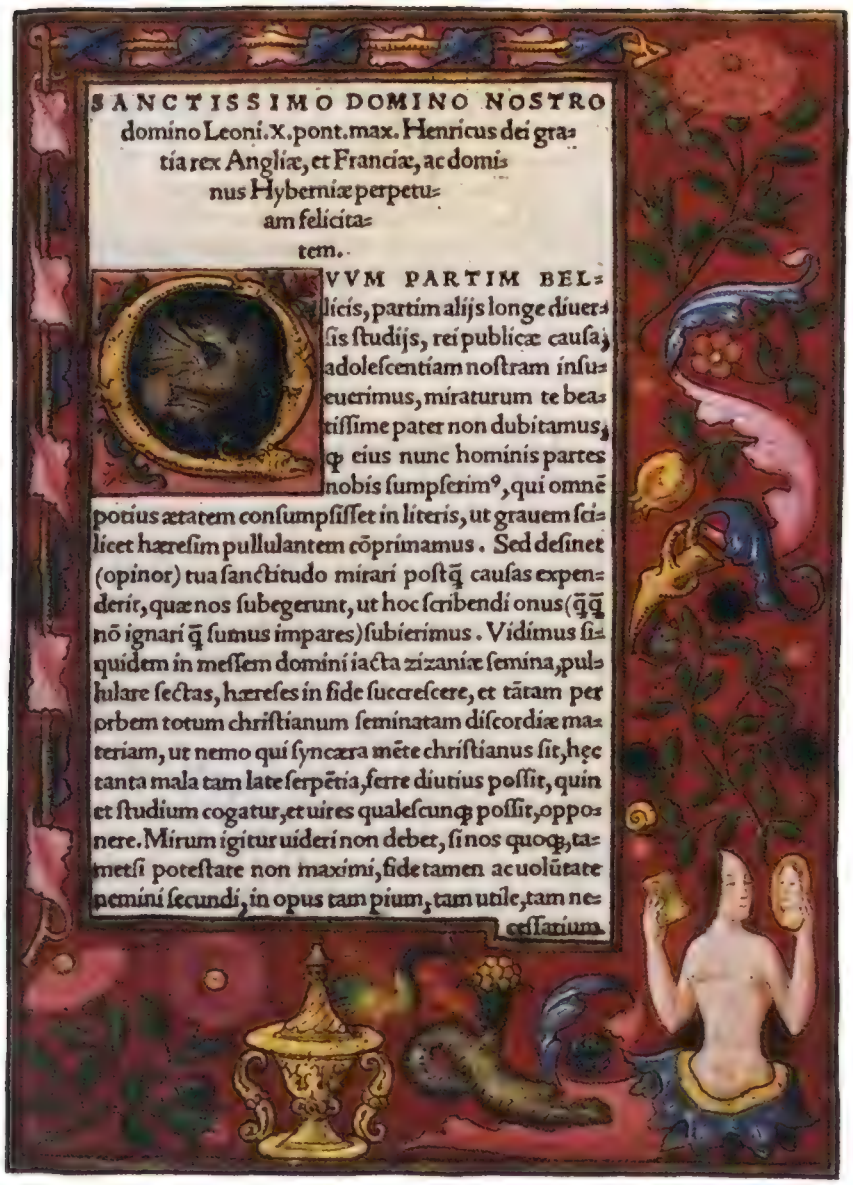
"We had the rare privilege as foreigners to be given access to the restricted vaults, and we found that only about 20 percent of the manuscripts were catalogued," Declan explained. "We tried to hunt out unknown items–things that even surprised the Vatican Librarian." Pointing to a large, detailed print of 16th-century Rome, he said: "This had previously only been seen as a group of separate panels. The library hadn't put it together like this."

Declan and his LC colleague Elizabeth Wulkan had steered me to a large case that housed a bird's-eye view of Rome, showing the great ancient structures (as they appeared circa A.D. 200) and also the beginnings of the modern city. My guides then prodded me toward the oldest display, a page from a Virgil text, handwritten around 500. The carefully penned "rustic" capital letters linked me instantly with the ancients and boggled my mind. Off to another case: an open spread of parchment. Declan drew my attention to three marginal notes. "Petrarch wrote those, six and a half centuries ago," he told me. Gulp.

The illuminated manuscripts–the Urbino Bible, Homer's *Iliad*, dozens of others–are dazzling with rich color. They include, of course, gold. I found that their brilliance reflects the radiance of the LC's own refurbishing–I needed only look up from a page to find the same brightness repeated in the ceiling.

The link between decorated pages and ornate murals would have been most apparent in the Renaissance, when everything was new. "The Vatican Library was near the Sistine Chapel," Declan said. "So it would have been quite natural for Michelangelo to pop in for a look at an illumination while he was working on the ceiling."

Books of science and math were decorated with diagrams. A ninth-century edition of Euclid's *Elements*, written in


SANCTISSIMO DOMINO NOSTRO
domino Leoni.X.pont.max. Henricus dei gratia rex Angliæ, et Franciæ, ac dominus Hyberniæ perpetuam felicitatem.

VVM PARTIM BELlicis, partim alijs longe diuersis ſtudijs, rei publicæ cauſa, adoleſcentiam noſtram inſumeuerimus, miraturum te beatiſſime pater non dubitamus, ꝙ eius nunc hominis partes nobis ſumpſerim⁹, qui omnē potius ætatem conſumpſiſſet in literis, ut grauem ſcilicet hæreſim pullulantem cōprimamus. Sed deſinet (opinor) tua ſanctitudo mirari poſtq̄ cauſas expenderit, quæ nos ſubegerunt, ut hoc ſcribendi onus (q̄q̄ nō ignari q̄ ſumus impares) ſubierimus. Vidimus ſiquidem in meſſem domini iacta zizaniæ ſemina, pullulare ſectas, hæreſes in fide ſuccreſcere, et tāram per orbem totum chriſtianum ſeminatam diſcordiæ materiam, ut nemo qui ſyncæra mēte chriſtianus ſit, hęc tanta mala tam late ſerpētia, ferre diutius poſſit, quin et ſtudium cogatur, et uires qualeſcunq; poſſit, opponere. Mirum igitur uideri non debet, ſi nos quoq;, tametſi poteſtate non maximi, fide tamen ac uolūtate nemini ſecundi, in opus tam pium, tam utile, tam neceſſarium

A preening mermaid, of all things, illuminates a 1521 text by Henry VIII in which he defends Catholicism.

Greek, explains the Pythagorean theorum with clear drawings that show the squares of the two sides of a right triangle adding up to the square of the hypotenuse (remember?). Ptolemy's astronomy is diagramed, and Galileo refutes Aristotle's theory that the sun is perfect by drawing the sunspots that he saw through his telescope in 1612.

Henry VIII has a couple of letters displayed here. One is a defense of Catholicism (above)–strange coming from a monarch who later refuted it–and another is to Anne Boleyn, the sweetheart who drove him to deny the church and divorce his first wife. After his signature, Henry sketched a little heart with the letters "AB," followed by the phrase "who will search no more." Protestations of love for the woman he would later have beheaded.

Musical scores, splendid maps, huge tomes on anatomy–bigger than *Gray's*. "We found a volume containing pressed flowers," Elizabeth told me. What did you do with it? "Closed the book very gently to keep them from turning to dust. They had been there for nearly 400 years."

James Billington hopes this spectacular exhibit is the first of many. "We dream of working something out with Armenia, where there's an important library. And there's one in Mongolia... Anyway, we want to keep exhibiting, keep showing the excitement of what we do." You have until the end of this month to see for yourself. Fortunately you have many years to savor subsequent exhibits and the new grandeur of the fine old Library of Congress.
Edwards Park

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QUEEN ELIZABETH 2
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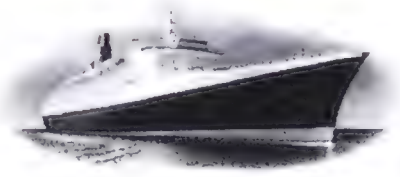


Will it be catching *La Bohème* at the Sydney Opera House? Watching elephants roam the plains of Kenya? Shopping in colorful, vibrant Hong Kong? It'll be difficult to decide as you circumnavigate the globe, visiting 6 continents and 33 breath-taking ports. Sail round-trip from New York on January 3, 1994 or from Ft. Lauderdale on January 5th for 100 days aboard the world-renowned QE2. And as a full World Cruise passenger you'll receive a range of special privileges, including a $2,000 per couple shipboard credit and "VIP" tours ashore. Fares range from $29,115 to $143,700 and include First Class air. If you don't have 100 days, winter vacations as short as 14 days are also available. For a free brochure or $8.95 video, call 1-800-221-8200. After all, you don't want to miss the most incredible experience of your life.

Rates are per person, double occupancy, subject to availability and dependent on departure date. Port and handling charges are $225 per person extra. Complete World Cruise fares include free First Class air from 78 U.S. and Canadian cities. QE2 is registered in Great Britain. © 1993 Cunard.

CUNARD

P49

Phenomena, comment and notes

The bad news is that our galaxy is not normal; the good is that we are near to discovering just what is at its core

All this time it has been like growing up in a house in which the room in the middle was kept locked and we were discouraged from asking about it, despite hints of powerful secrets kept inside. We could speculate to our hearts' content, but we could not see through the door or even the keyhole, and so we never knew. Now, in a rush, we are finding out.

Astronomers routinely study the centers of galaxies, particularly those that emit so much radiation that they are known as active galaxies. There is one galaxy, however, whose center they have never seen: our own.

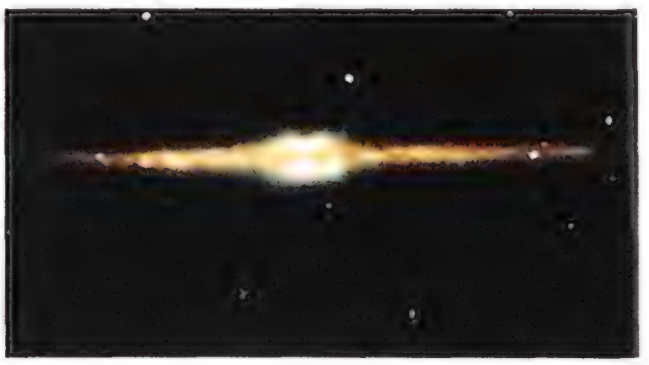
We can visualize the rest: a disk with a central bulge, something like two fried eggs or two drummer's cymbals back to back. Seen edge-on, it is a thin strip with a central bulge; seen from top or bottom, it is a pinwheel of stars and hot gases with a bright, glowing center (SMITHSONIAN, January 1989).

The actual center, the core of the bulge, remains a mystery. Astronomers have known since 1932 that something unusual is going on there, something powerful, but intervening clouds of dust totally obscure it at visual wavelengths. The center lies in the constellation Sagittarius, behind the rich fields of foreground stars that we can see. We do detect a blur with radio telescopes (that's how we know something strange is happening) and see more at infrared wavelengths from telescopes carried to high altitudes by balloons, rockets or satellites. In the past year or so, we have been able to put together these observations and paint a better picture than we have ever had before.

Now five astronomers, including Paul T.P. Ho at the Harvard-Smithsonian Center for Astrophysics, have brought the rest of us up to date in a review article in the British science journal *Nature*. They describe it in the technical jargon required of all card-carrying scientists, but in almost every paragraph remarkable, counterintuitive pictures emerge. It becomes very clear that if any of us could somehow be magically transported to the center of our galaxy, we would be overwhelmed at the sight. We would fervently wish we could use all the words that have been so debased through overuse and misuse: "awesome," for one.

It is a place where stars are so close together that there would be no darkness: the entire night sky would blaze with stars brighter than any we see from Earth: freeze-frame fireworks. Some actually collide or come so close that gas is pulled from one star to another. Heavier stars are continually collapsing to trigger supernova explosions, like flashguns going off at a news conference. How crowded is it? In our part of the Milky Way, two-thirds of the way out from the center, it's a long way from one star to the next. As astronomers measure it, the density is about one-tenth of a sun per cubic parsec (a parsec is 3.3 light-years, or about 19 trillion miles; a cubic parsec is simply a cube that is one parsec on each side). In the cluster at the core of our galaxy, the density of stars is a million or more suns per cubic parsec.

The great clouds of gas orbiting the center do not circle sedately. Some gas is falling inward; much of this is blowing out from the center in a galactic wind analogous to the solar wind that bathes Earth and all the other planets. Great loops of gases rise above the galactic plane, looking for all the world like the prominences that rise from the surface of the sun. Those on the sun are mea-



Infrared image from COBE satellite shows the central region of our galaxy.

THE METROPOLITAN OPERA PRESENTS

Parsifal

Illustrations based on photography by Winnie Klotz

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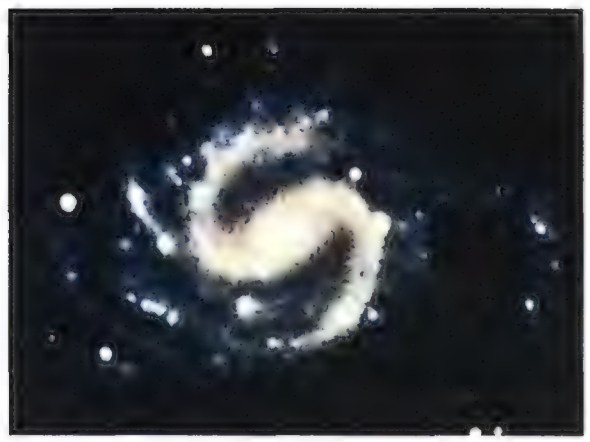

From above, Milky Way probably looks like this; arms are connected by central bar.

sured in thousands of miles; the loops at the galactic center typically measure more than 100 light-years. There is even some evidence that at the poles of our galaxy, just as we see elsewhere in the Universe, the outflowing galactic wind may be concentrated into focused jets in which hot gases stream out at hundreds or even thousands of miles per second. Our galaxy is a quieter version of the active galaxies we see elsewhere, but then, it is well into middle age. It is possible that when the Milky Way was new, it, too, was an unthinkably violent place.

For me the review article includes two surprises. The first is the disappointment of finding out that we are not normal. For all these years we have all believed that the Milky Way was a classic spiral, what astronomers call a "normal" galaxy. For half a century, I had believed that we looked like our neighbor, the Andromeda Galaxy: a pinwheel of stars. The books said the central bulge had something of the shape of the sun: a spheroid slightly flattened at the poles. It is not a spheroid at all: the bulge turns out to be a bar that we see almost end-on. The pinwheel begins not from the center but from the ends of the bar. We live in a barred galaxy. Half of all disk galaxies are barred, but somehow I have an uneasy feeling that it is a bar sinister.

The news is confirmation, not revelation. Back in 1964 Gerard de Vaucouleurs, noting that gases do not orbit the center of our galaxy in nice circular orbits, suggested the existence of a bar. But it is only in the past year, according to the authors, that new evidence has made it certain that our galaxy is indeed barred, a barred spiral to be exact.

The second surprise comes in finding out that it is by no means certain that a black hole with the mass of a million suns sits at the center of our galaxy, and that the powerful radiation we see comes

from gases being accelerated and compressed as they are drawn into that bottomless maw. That hypothesis may not even be the leading contender. The review authors themselves lean toward an alternative theory, that the radiation is coming from a tight cluster of highly luminous stars, possibly the product of a recent burst of star formation. That, too, is somehow disappointing; there is no monster at the center, no hellish whirlpool carrying everything that comes near down and out of sight forever.

Of course this last is still a matter of dueling theories. We know a lot more about the center of our galaxy, but we still do not know for sure what sits at the very core. The center is dominated by a radio source known as Sagittarius A. Better telescopes have revealed that it is actually two sources of radio waves: Sagittarius A East is about 26 light-years across—the radiation coming from it seems to be largely the work of supernovas. The radio source Sagittarius A West is smaller, only about 6.5 light-years across, but it sits in a disk of turbulent molecules that extends about 23 light-years out from the galactic nucleus. Within the disk is a cavity about 6.5 light-years across: this is the site of the radio source emissions we detected.

Most interesting of all is an extremely powerful point source of radio waves known as Sagittarius A*. Smack in the middle of the more extended radio source, it is widely believed to be the core or nucleus of the Milky Way. We have found the equivalent of the Wizard of Oz behind his curtain, but we cannot yet say what it is. The emissions could come from matter falling into a black hole, although the energy released is much lower than that seen in truly "active" galaxies. (At the moment, we are certain that black holes reside at the centers of those galaxies because nothing else could account for so much radiation coming from such narrow sources.) It has been suggested that it is merely a neutron star plowing through a dense gas cloud. There is also a star cluster at the core, however; one radio source there, IRS16, which is only about a tenth of a light-year from Sagittarius A*, is considered the core of the cluster. That object in turn can be resolved into several dozen young, hot stars. These stars are bright and hot enough to account for the radiation coming from the core, but their light exhibits unusual characteristics. It may be they are passing so close to one another that they raise enormous tidal distortions or even actually merge.

Even though the authors currently think clusters of hot stars can account for what we see coming from the core, they urge a continuing search for a black hole. One positive sign, they say, would be an outburst of luminosity with any sudden increase in the amount of matter falling into it. Nothing like that has been seen since Sagittarius A* was detected in 1974, but 20 years is not a long time.

What is unambiguous is that the center of the galaxy is an extraordinary place, like nothing we have dreamed of. Now my fantasy is to travel from the provinces to the capital, so to speak. Pick out a decent planet orbiting one of those countless stars in the central region of our galaxy. I want to arrive on the day side, get to the hotel, settle in, have a quiet dinner. As the planet's sun sets, I want to walk out on the beach in front of the hotel, slathering on sunscreen to protect my skin from starburn. Then I'll watch the stars come out. By the hundreds. By the thousands. By the millions. *John P. Wiley jr.*

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Smithsonian highlights

Planning a Smithsonian visit?

Receive a special free Associates' Planning Packet. Write Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560, or call (202) 357-2700; hearing-impaired service, TTY: (202) 357-1729. *Note:* Parking near Smithsonian museums is limited. Members are encouraged to use the convenient Metrorail subway system, with parking available at some stations (details in packet).

Begin your visit at the Smithsonian Information Center's Associates' Reception desk—open from 9 A.M. to 4 P.M. daily—in the Castle. The Court dining room, located in the National Museum of Natural History, is open daily, 11 A.M. to 3 P.M.

Most Smithsonian museums are open from 10 A.M.-5:30 P.M. daily, except December 25. Hours at the National Zoo are 9 A.M.-4:30 P.M. daily for buildings; and 8 A.M.-8 P.M. for grounds, starting April 15.

Freer Gallery to reopen

The Freer Gallery of Art is scheduled to reopen May 9, 1993.

Smithsonian Craft Show

The 11th annual Smithsonian Craft Show, sponsored by the Smithsonian Women's Committee, will be held April 15-18 in the Andrew W. Mellon Auditorium, 1301 Constitution Avenue, N.W., across from the National Museum of American History. One hundred artists will exhibit and sell work in a variety of media. There will be an admission charge. See *Highlights continued*, page 30.

In conjunction with the Craft Show, the James Renwick Alliance will offer its annual spring forum April 17-18. For details, call Shelley Gollust, (301) 229-2148.

Musical Weekend

This year's Smithsonian Musical Weekend, April 30-May 2, marks the 21st anniversary of the Friends of Music at the Smithsonian. Highlights include performances by the National Symphony Orchestra and the Smithsonian Chamber Players; dinners at the Renwick Gallery and National Air and Space Museum; tea and music at the Moroccan Embassy; and breakfast at the Zoo. Write: Musical Weekend, Box 11271, Washington, D.C. 20008.

Special April exhibits, events

National Air and Space Museum
Where Next, Columbus? New gallery looks ahead to the next 500 years of exploration. Show examines the scientific, technological, economic, ethical and political issues involved in future space travel.
Legend, Memory and the Great War in the Air Permanent installation looks at the reality of aviation in World War I.
Hidden Hawaii (opens April 3; 6 P.M. on selected evenings) New Imax film features breathtaking underwater footage.
Beyond the Limits: Flight Enters the Computer Age Major gallery explores the computer revolution in aerospace.

National Museum of American History
The Past as Memory and Model (April 20-June 28) Display commemorates opening of the United States Holocaust Memorial Museum (see page 50), underscoring the survival of European Jewish culture despite the Holocaust.
Beyond Category: The Musical Genius of Duke Ellington (April 29-September 6) Exhibit organized by NMAH and the Smithsonian Institution Traveling Exhibition Service looks at 50-year career of the celebrated composer, bandleader.
American Encounters Permanent exhibit focuses on the American Indian, Hispanic and Anglo-American cultures of New Mexico's Upper Rio Grande Valley.

Clay figure (1990) by Nora Naranjo-Morse is in "American Encounters" at NMAH.

Hirshhorn Museum & Sculpture Garden
Directions—Alison Saar (April 1-June 27) Themes and archetypal figures from contemporary African-American culture are the focus of 24 reliefs and sculptures by the New York-based artist.
Susan Rothenberg: Paintings and Drawings (through May 9) Retrospective encompasses 20 years of work by the contemporary American artist, a key player in the revival of figurative painting.

National Museum of Natural History
Saynday was coming along...Silverhorn's Drawings of the Kiowa Trickster (through May 31) Drawings by the 19th-century American Indian artist illustrate adventures of Saynday, the Kiowa Trickster.
Seeds of Change (through May 23) Exhibit explores the changes brought about by the exchange, begun 500 years ago, between the Old World and the New.
The American Wildlife Image and Charles Fracé (through May 2) Paintings by the noted American artist capture animals in their natural habitats.

National Zoological Park
Amazonia New permanent installation recreates a microcosm of the world's largest rain forest and river habitat. Exhibition explores the wonders of this richly diverse ecosystem.

National Portrait Gallery
American Art at the 1893 World's Fair (April 16-August 15) Exhibition brings together 100 of the paintings and sculptures displayed at the 1893 World's Columbian Exposition in Chicago. Show includes works by Thomas Eakins and Winslow Homer, is held jointly with the National Museum of American Art.
"The Family 1976": Richard Avedon's Portraits for Rolling Stone (through June 6) Portraits by the famed photographer capture America's most powerful figures of the Bicentennial year.

National Museum of American Art
American Art at the 1893 World's Fair (April 16-August 15) See National Portrait Gallery listing.
American Impressions: Masterworks from American Art Forum Collections, 1875-1935 (through July 5) Masterpieces of American art by such artists as Albert Bierstadt, Childe Hassam, Robert Henri.
Paul Cadmus (through August) Installation of ten works features the artist's controversial 1934 painting *The Fleet's In!*

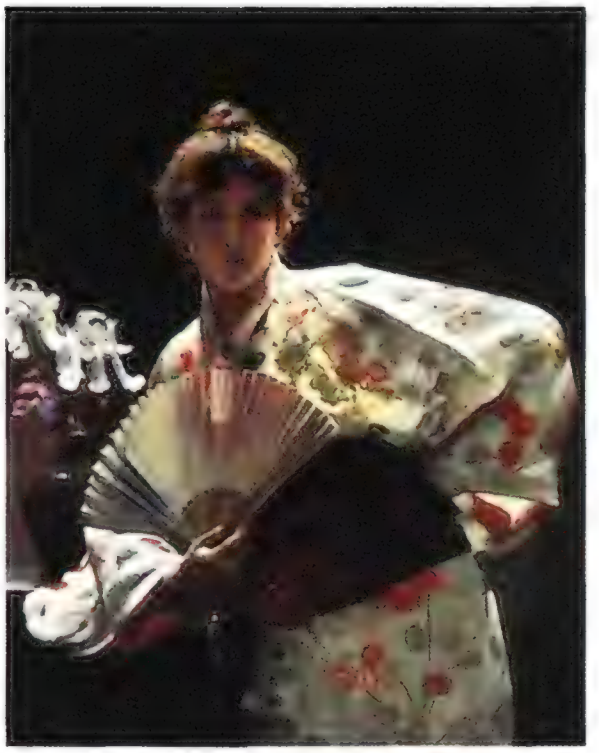
Renwick Gallery
American Wicker (April 2-August 1) Exhibition traces the history and stylistic evolution of American woven furniture from 1850 to 1930. Show features fancy Victorian chairs, simple Arts and Crafts designs.

Arthur M. Sackler Gallery
Joined Colors: Decoration and Meaning in Chinese Porcelain (through November 28) Exhibit of 15th- through 19th-century polychrome porcelains focuses on their significance as bearers of auspicious images and emblematic colors.
The Golden Age of Sculpture from Sri Lanka (through September 26) Exhibition of 52 ancient masterpieces of bronze casting includes many of the major monuments of Sri Lankan art.

National Museum of African Art
Astonishment and Power: Kongo Minkisi and a New World Resonance (April 28-January 2, 1994) Exhibit explores both the *minkisi* tradition of the Kongo peoples of central Africa and the contemporary art of Renée Stout, an African-American artist who draws on their traditions.
Elmina: Art and Trade on the West African Coast (through May 2) Show looks at the early encounter between Africa and Europe by focusing on Elmina, a trading post set up in 1480 on Africa's Gold Coast.

Anacostia Museum
Body and Soul: The Alvin Ailey American Dance Theater (through June 13) Exhibition celebrating the 35th anniversary of the famed modern dance company features costumes, posters, programs, and original costume and prop designs by Romare Bearden and Randy Barcelo.

Arts and Industries Building Experimental Gallery
Mirror of the Martyrs (April 1-July 11) Exhibition uses historical materials, artifacts and storytelling to stimulate discussion about contemporary questions of freedom and order, unity and diversity.



Charles Sprague Pearce's *Lady with a Fan* is in NMAA's "American Impressions."

International Gallery, S. Dillon Ripley Center
The Egypt Story: Photographs by Fred Maroon (April 9-June 13) Images document the land, the architecture and the people.

Cooper-Hewitt Museum (New York)
Czech Cubism: Architecture and Design (April 6-July 25) Major retrospective of Cubist-inspired architecture and design features original drawings, furniture, ceramic and metal objects.
A Memorial to Jan Pallach (April 6-September 26) Exhibit documents memorial built in Prague to Czech student who committed suicide in 1969 in protest of persecutions of Prague Spring.

Exhibition catalogs

Catalogs available currently include:
American Wicker ($45/$25 paper)
Revisiting the White City: American Art at the 1893 World's Fair ($60/$35 paper)
Astonishment and Power: Kongo Minkisi/ The Art of Renée Stout ($34.95 paper)
Susan Rothenberg: Paintings and Drawings ($30/$21.95 paper)
To order, send check or money order to Smithsonian Museum Shops, 8308 Cinder Bed Road, Newington, Virginia 22122. Include 15 percent of purchase to cover postage, handling (minimum, $1.75).

Office of Elementary and Secondary Education

The Office of Elementary and Secondary Education (OESE) offers a variety of programs, publications and services for teachers of prekindergarten through grade 12 nationwide. OESE's quarterly journal, *Art to Zoo*, is a curriculum enrichment tool for teachers of grades 4 through 6. Each issue focuses on a relevant topic in science, history, art or the humanities and includes a lesson plan, classroom activity suggestions and a bibliography. To request a free subscription, write: OESE, Smithsonian Institution, Arts & Industries Building 1163, Washington, D.C. 20560.

Smithsonian on the air

Folk Masters Taped live at the Barns of Wolf Trap, Radio Smithsonian series presents performances of uniquely American music. Check local public radio listings. To obtain a free copy of the companion *Listener's Guide*, write: Office of Telecommunications, Smithsonian Institution, National Museum of American History BB40, Washington, D.C. 20560.

Resident Associate Program

To become a Resident Associate, or for fee and ticket information, call (202) 357-3030. April events include:
On the Eve of the Maya Millennium (April 5; 6 P.M.) Archaeoastronomer John B. Carlson gives a slide lecture on the rise and fall of the Classic Maya.
Turmoil and Triumph: My Years as Secretary of State, An Evening with George P. Shultz (April 30; 6 P.M.) The former Secretary of State discusses highlights from his book *Turmoil and Triumph.*
The Politics of the Modern Military (April 15; 6 P.M.) Adm. William J. Crowe jr., former Chairman of the Joint Chiefs of Staff, offers a unique insider's perspective.

Smithsonian Institution Traveling Exhibition Service

SITES organizes and circulates exhibitions to cities throughout the United States and abroad. To sponsor a show in your community, write SITES, Smithsonian, Washington, D.C. 20560. Here are some April exhibits:
• Columbia, South Carolina (April 2-May 23) *Art as Activist: Revolutionary Posters from Central and Eastern Europe*, Columbia Museum of Art (see page 118).
• Fullerton, California (April 10-May 23) *The Realm of the Coin: Money in American Art, 1960-1990*, Fullerton Museum Center.
• Little Rock, Arkansas (April 1-May 16) *Songs of My People*, Arkansas Arts Center.

A showcase of American crafts

"In endorsing 1993 as the 'Year of American Craft,' Congress is asking this country to acknowledge the excellence, creativity and ingenuity of American talent," says Carol Sedestrom Ross, former senior vice president of the American Craft Council and one of the jurors of this year's Smithsonian Craft Show. "These qualities are all very much in evidence in the work of the artists chosen to participate in the 1993 show."

Selected from more than 1,200 applicants nationwide, 100 artists will exhibit a rich and remarkably varied array of crafts–from sleekly polished glass vases to boldly painted floorcloths, from high-tech jewelry to whimsical sculpture, from fluted wooden bowls to woven metal baskets.

Sponsored by the Smithsonian Women's Committee, the 11th annual exhibition and sale will be held April 15-18 at the Andrew W. Mellon Auditorium on Constitution Avenue, across from the National Museum of American History. There will be an admission charge.

"The works on display at this year's show reveal not only a mastery of technique, but an extraordinary level of sophistication and esthetic achievement," says Jeremy Adamson, associate curator at the Renwick Gallery and another of the event's jurors. "This says a great deal about the good health of crafts in the United States today."

Diane M. Bolz

A. B. Gardner used wood, buttons, copper, to fashion mixed-media painted head.

Emily Rossheim's slab-constructed clay bowls have airbrushed underglaze colors.

New York artist Peter Secrest created eloquent simplicity of blown-glass vase.

Bold, playful forms adorn painted canvas floorcloth rendered by artist Hilary Law.

"Rap fish" wind machine by Jane Corbus, Jeff Crewe, is of plastic, metal, wood.

Elegantly painted silk scarf with screen-printed overlay was made by Sally Jones.

Wheeled Thing by James Eaton is painted cast aluminum, stands 22 inches high.

A query, if we may.

How do you get a vision that's in your head onto a piece of film not much larger than your average postage stamp?

No, this is not a trick question.

SB-25 with D-type AF Nikkors offers 3D Multi-Sensor Balanced Fill Flash. Also has Slow/Rear Sync, Red Eye Reduction, and FP Flash-Sync up to 1/4000th.

It's what photographers challenge themselves with day and night. In this case: day. Barely.

You see, pro photographer Roger Ressmeyer knew the sun was setting and lighting conditions were changing rapidly. He knew the windsurfer was moving erratically. He knew he only had an instant, or less, to get it. He knew it was almost impossible.

He knew, however, that he had the new Nikon N90. A camera designed to let you walk away with shots from situations you would ordinarily walk away from.

The Nikon N90 has Advanced 8-segment Matrix Metering, with powerful software which analyzes exposure instantly and accurately even in difficult light situations. Instances when you have no time to think, let alone meter. With our new D-type AF Nikkor lenses, which actually incorporate subject distance information into the exposure, Matrix Metering moves into a new dimension. Quite literally. It becomes 3D Matrix Metering.

See the new N90 at authorized Nikon Dealers wherever you see this symbol. For more info on the new Nikon N90, and the exclusive Nikon MasterCard, call 1-800-NIKON-35.

The N90 even knows when you've recomposed. It compares the lighting patterns from your original composition to those in your new one. That way, what you see will be perfectly exposed on film. Ask Roger.

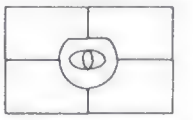
Imagine the same technology in flash photography. By way of the world's only 5-segment TTL flash sensor, the Nikon N90 used with our SB-25 Speedlight can perform Matrix-like analysis of the scene with Monitor Pre-Flash for ideal flash output. So you can get shots you would never have dreamed of trying before. A severely backlit portrait. A bride in white, running through a shower of rice as the sun sets.

It's designed to make the most of an invaluable piece of equipment you already have.

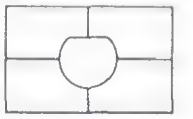
Your eye.

{The Nikon N90 System.}

The Nikon N90's new advanced CAM 246 Autofocus Detection System focuses accurately in an instant. It has a Wide-Area Focus Detection Sensor that's nearly 20% of the frame width, for more creative composition, even if the subject is off center or moving. Like a windsurfer at 20 knots for instance.



With an 8-segment ambient Matrix Meter, remarkably powerful Nikon software, as well as the world's first five-segment TTL flash sensor, the N90™ provides you with an unprecedented degree of control.



And what's more, with the Nikon Data Link System, you can connect the new Nikon N90 to a Sharp® Electronic Organizer, so you can control the camera remotely and customize operations for the way you like to shoot.

Yet another accessory with creative features is the MF-26 Multi-Control Back. With it you can auto-bracket ambient exposure, and auto-bracket flash output, among other things. So that you can rest assured you've got the shot.

Combined with this new technology, there is a solid connection to Nikon's past. Our timeless F-bayonet mount accepts nearly 80 Nikkor lenses. Including our new D-type AF Nikkors and high-speed AF-I Nikkors.

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You would imagine that shooting a moving windsurfer at dusk from a rocking boat would be sheer hell. But with the N90's innovative 3D Matrix Metering, CAM 246 Wide-Area Autofocus, Multi-Sensor TTL Flash with the new SB-25 Speedlight, and a 35-70mm f/2.8 D-type AF Nikkor lens, Roger Ressmeyer made the experience pure paradise. Then again, he was shooting in Hawaii.

Of course there's one thing this camera can't give you. The vision inside your head. The idea that sparks a feeling. The thought that provokes an inquiry. The brainchild that makes someone say "man, what a picture."

That's up to you. Question is, which photographic tool are you going to choose to turn that vision into reality?

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Prescription drugs can help patients like Phyllis avoid disabling strokes and nursing home care, which averages over $30,000 per year.

Ask Phyllis her opinion of the anti-stroke drug that lets her hold onto her independence and life savings.

When medicines can help people like Phyllis avoid a stroke, that's obviously a good thing. What's not so apparent is how dramatically the same drugs reduce nursing home costs.

Stroke often leaves survivors so disabled they require nursing home care which now averages over $30,000 a year per patient.

But drugs that reduce the risk of strokes are helping individuals and families avoid such a huge financial blow. And helping to hold down the nation's expenditures for nursing home care, estimated at $66 billion a year.

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DELTA
DELTA

Sunrise finds jet aircraft already in motion at the nation's largest (in Texas, of course) airport. Above, Curt Kuehner checks a two-mile-plus runway for bits of concrete and hardware that could damage planes.

By Jay Stuller

With 2,100 flights a day, this airport is a city that never sleeps

At huge Dallas/Fort Worth, 35,000 people work around the clock so that annually 50 million passengers are able to get where they are going

As the December sun begins its climb over the rim of the North Texas prairie, Curt Kuehner wheels his yellow station wagon onto Runway 17 left and 35 right, the vehicle's flashing roof lights tracing amber circles on the concrete. An assistant airfield operations officer, the 30-year-old Kuehner starts a slow cruise down the runway's 11,400-foot length. His practiced eyes scan for lightning strikes, which can blow holes in concrete and scatter pebble-size pieces of debris for yards.

He also looks for bolts, nuts and other scrap that, more often than most of us would care to realize, fall off airplanes. On the landing zones, painted solid black by high-speed encounters of tarmac and tires, Kuehner searches for the remains of any jackrabbit that may have hopped in harm's way.

"It's gruesome scraping bunnies and birds off the concrete," says the former Air Force mechanic, whose group is responsible for airfield safety. "What you really worry about are bolts and pieces of cement, which are dangerous to aircraft and nearby work crews. Jet blasts can shoot debris at 100 miles per hour. The weirdest thing I ever found was a fish, a 12-inch bass. I figure a seagull probably dropped it."

Today the runway is clear, and at its end Kuehner abruptly turns and guns his engine, heading fast for an

Photographs by Cameron Davidson

Air traffic controller Kenneth Kelly mans a console in the tower. He's part of 150-person team that handles 2,100 landings and takeoffs a day. Binoculars verify what the radar tells them.

exit ramp. In a matter-of-fact voice he radios the control tower: "Tower port, this is one-ten. You can show Runway 17 left and 35 right as open." The message is brief, the stuff of routine procedure. But in another sense, at 6:50 A.M. Central Standard Time, Curt Kuehner has turned a key. The Dallas/Forth Worth International Airport—the nation's largest operating airport and the world's second-busiest after Chicago's O'Hare—is ready for the rush.

From the day it opened in January 1974, DFW has never really closed, save for a few hours in the aftermath of a pair of fatal crashes in the 1980s. Midway between Dallas and Forth Worth, the 28-square-mile leviathan has six major runways that accommodate some 2,100 takeoffs and landings daily. Through its four terminals pass more than 50 million passengers annually, and through its cargo areas about 675,000 tons of goods. Thanks to reasonably reliable weather, a midcontinent location and direct service to 200 worldwide destinations, DFW has emerged as one of the nation's most important air transit hubs.

Run by the Airport Board and its 1,400 employees, DFW's 18 tenant carriers and supporting businesses employ another 34,000 people. It's thus a city unto itself, with police-and-fire department, jail, transit system, public works department, restaurants, shops and hotel on the airport proper.

Designed and built in an era when air travel had a more gracious ambience, DFW is today a crush of humanity. A modern airport is a caldron of raw emotions, stress and anxiety, with passengers fretting about making connections, whether to meetings or vacation escapes. It's an environment in which every pathology of the species, from heart attacks to crime and plain old rude behavior, comes to the fore.

That DFW handles passengers so well—given the airport's sprawling layout, Skinnerian maze of roads, confusing signage and a "people mover" that's driven more than a few riders nuts—is remarkable. As it approaches its 20th birthday, DFW is in motion around the clock, a frenetic concert of aircraft, people and equipment that surge in powerful arrhythmic pulses.

6:51 A.M. In the airy loft of the Federal Aviation Administration (FAA) tower, a controller slides a small, rectangular piece of red plastic marked "17 L" and "35 R" out of a slot, a simple and effective warning cue to the runway's closure. In its place he now slides a piece of paper imprinted with numbers representing a flight that's about five miles out from the strip Curt Kuehner has just finished inspecting. "One-ten, this is tower port," the controller says into his headset mouthpiece. "We show Runway 17 left and 35 right as open, and thank you."

While a blinking light on a radar screen indicates the incoming aircraft's position, the controller takes binoculars in hand and searches for the plane's landing lights in the low clouds and fog north of the airport. Switching radio frequencies, he instructs the

San Francisco-based Jay Stuller offered a history of cleanliness in the February 1991 issue. He confesses he prefers flying into smaller airports.

Automated electric cars carry passengers between the four terminals and to and from parking lots. The cars move on rubber tires at 17 miles per hour, circling the whole airport in 30 minutes.

flight to land on 17 left. Six sets of landing lights are now visible, like a cluster of morning stars converging on DFW.

Down at the terminals, outbound airliners are moving back from the gates. "It's the day's first push," says Greg Juro, the FAA's assistant manager for procedures, surveying the four casually dressed controllers positioned at the tower's corners. "Over the next 30 minutes, we'll have 58 arrivals and 40 departures."

As aircraft line up on DFW's taxiways, the tower's atmosphere undergoes a subtle but perceptible change. From a spiral staircase that leads to its deck, another controller steps in. Silently, with no acknowledgment from those already on station, she plugs a headset into a radio. Soon, eight controllers work the field.

Voices are never raised, but one can feel an increase in human energy as the aerial activity spikes upward. "This is no place for rookies," says Juro, a former controller. In fact, DFW is so big and busy that its east and west sides are run like separate airports; two new FAA towers, one for each half of the field, go into operation next year.

"Many of the 2,100 daily takeoffs and landings are compressed into what we call surges, banks or a push," adds Juro. "There used to be a fairly distinct break in the activity between them. These days, the lulls seem to be getting shorter and shorter."

7:32 A.M. On the faces of many passengers pouring out of the gates in Terminal 3E is the look of incipient panic, especially for those who sense there's little time to make a connecting flight. In the "hub and spoke" system used by both American and Delta airlines, DFW's two largest carriers, a bank of aircraft is scheduled to arrive about a half-hour to 45 minutes before another bank departs. Low clouds and fog, and a big storm in the Northeast, have delayed incoming traffic.

Standing at Gate 33, wearing a red sport coat and a look of self-assurance is Norm Draper, a 29-year veteran of American's passenger service group. "Redcoats," here and at Delta's operation, tackle matters that gate agents don't have time or authority to handle. Draper holds a printout that shows how many people on the arriving flight have connections, and their gates and departure times.

"Connections, connecting flights," announces the mustachioed Draper. "Albuquerque?" asks one man. "Gate 34, right next door," answers Draper, pointing to his right. "Lubbock? And I think I've got only five minutes to make it," says another. "Gate 28 and not to worry," says Draper. "We've delayed the departures, so you've got 15 minutes." He's then confronted by an overweight woman with a bad ankle, her three carry-on bags tangled around a walking cane. She's headed for Seattle. "Don't worry, we'll get you there," soothes Draper, calling for an electric cart.

For the next quarter-hour, the narrow terminal is a swarm of people lugging baggage, buying magazines at a gift shop, hustling to make connections. And then, just as quickly as it filled up, Terminal 3E is strangely empty.

8:05 A.M. As the automatic door closes on the small, electric-powered car and the vehicle lurches down its concrete guideway on rubber tires, a passenger takes a

second look at a route map and at a terminal receding into the distance—and realizes that he's made a big mistake. "Damn!" he blurts to no one in particular. "I could have walked a hundred yards back to 2W, and now I'm stuck circling the airport. Idiot!"

Welcome, sir, to AIRTRANS, perhaps the signature feature of DFW International. With 66 cars operating on 13 miles of guideway, AIRTRANS was one of the nation's first fully automated transit systems. Connecting the four terminals to long-term parking lots, the cars reach a top speed of 17 mph and cover most routes in 12 to 15 minutes. Catch the wrong route—for the trains go in only one direction—and it can take 30 minutes to circle the airport.

8:45 A.M. A simulcast goes out over all airport radio frequencies—a notification of a bomb threat, the device allegedly in a bag on a McDonnell Douglas Super 80. With passengers evacuated, the plane is driven to a taxiway at the northwest corner of the airport, while the adjacent runway is closed. Within minutes several squad cars from the Department of Public Safety (DPS) arrive. Lt. Bill Baker takes on-site command. Bomb-sniffing dogs are on the way.

The airport receives one or two bomb threats per month. While they are usually no more than a threat, Baker and the DPS treat every one as real. Soon after the MD-80 is parked, Baker orders Cpl. Phil Reeves to take his dog, Rex, through the bags. Cpl. Jerry Selph and his canine partner, Speaker, check out the rest of the aircraft. The dogs are trained to sit at the scent of any component of explosive.

Rex and Speaker remain on their paws. The aircraft is clean. But the dogs can be fooled. "A couple weeks ago we had a bag that looked like it was smoking," says Capt. Steve Deel, observing Speaker and Rex at work. "The dogs sat, so we thought it was a real bomb. Turns out a can of hair spray in it got jammed open and filled the bag with mist, which leaked out and looked like smoke."

Sharpshooters, equipped with .308 caliber Styers rifles, are on team that responds to hostage-takings.

Paramedics Doug Cowles (bending forward) and Larry Dietz (at rear) and others attend to an ill passenger.

Forty-five minutes after the threat was received, the MD-80 is headed back to the terminal. "We know where the call came from and have a recording of the voice," says Baker. "What we don't know is why it was made, or if we'll catch 'im."

Ramrod straight with gray hair, Bill Baker has been with the DPS since the airport opened. Like all 314 members of the force, he's cross-trained as a fireman, police officer and paramedic. Because of the diverse training, DFW's officers make up one of the most elite public safety forces in the country.

"We're driven by what you need in the event of an aviation disaster," explains Chief Len Limmer, who has headed the DPS since its inception. "If a plane crashes, what you need first is a whole bunch of firemen. As soon as the fire's out, you need paramedics to treat survivors. Then you need cops for crowd control. Instead of hiring three separate groups, we cover everything with one, which also has day-to-day benefits. We pay more than most police and fire departments, but I tell the Airport Board that they get three people for the price of one and a half."

Officers patrolling the terminals on foot are on "air

Most often they use only their scopes, which enable them to see what is happening 500 to 600 yards away.

piracy" duty. Airlines are responsible for passenger screening, but if a metal detector reveals a weapon, DPS officers respond. Despite warning signs and two decades of such airport security, people still carry guns into terminals. About 85 percent of the putative pirates are women who forget they're packing handbag pistols. Nonetheless, they're busted on the federal offense.

More often, the officers are a presence, handling shoplifters and other disturbances. Outside, patrol car and motorcycle officers cover traffic violations and guard against parking lot thefts. Still others serve primarily as paramedics or firefighters. Some are members of the Special Reaction Team, which in nearly 20 years has dealt with several hostage situations—all of them turned out peacefully.

9:30 A.M. In DFW's administration office, Joe M. Dealey jr., the Airport Board's public affairs director, is about to leave for a hearing on airport expansion. "Forecasts show that by the year 2010, operations here will double to 100 million passengers per year and 1.25 million flights," he says. "We've got land that will accommodate growth, but we need to build more infrastructure and two new runways. Their impact would go way beyond this airport. A Department of Transportation study said that simply adding those two runways would increase the national air system's capacity by 15 percent."

With complaints about noise and concerns about the environment, several nearby communities oppose expansion. The conflict is ironic, for an initial complaint about DFW was its remote location, approximately 17 miles from the centers of Dallas and Forth Worth. "Some critics said that the size of DFW—you can put 20 Love Fields in it with room left over—was the result of Texas ego," recalls Dealey, a former *Dallas Morning News* executive. "Maybe, but I think it also showed vision. If you look at aerial photos from 1974, there's nothing around the field. Today, development has edged right up to its boundaries." Numerous businesses have built next to the airport. American Airlines has its corporate headquarters here, and the field generates an estimated $6.5 billion for the DFW Metroplex economy. The decision to locate the Superconducting Supercollider, which will be the world's most powerful accelerator of subatomic particles, in Waxahachie, Texas, was based partly on its proximity to the airport.

10:20 A.M. Ever since she was a little girl growing up in nearby Arlington, Texas, Angela D. Hinds wanted to be a firefighter. After two years as a DPS officer, she's cross-trained as one. "But now I really like being a cop," she says, maneuvering her patrol car through airport traffic. "My goal is to be one of the motorcycle jocks and get a place on the Special Reaction Team."

Most of Hinds' arrests are for drunk driving or for outstanding warrants found during traffic stops. The DPS has its own jail and holds prisoners until officers from local jurisdictions come for the offenders. "Inside the terminals we take a gentle hand," says Hinds. "For one thing, the airlines don't really want us arresting passengers. For another, we know that travelers are under pressure. If someone is yelling at a gate agent, we try real hard to calm them down before making an

Acting on a bomb threat, Jerry Selph and his dog, Speaker, check luggage that has been taken off plane.

A giant airport that never sleeps

arrest. We're a little more tolerant than most city cops."

While driving past Terminal 4E, Hinds hears a distress call. Inside, there's an incoherent woman with severe abdominal cramps, possibly suffering from gallstones. Hinds pulls over and heads in; an air piracy officer is already with the afflicted passenger. In seconds, a team of paramedics is at her side. Officer Doug Cowles gently asks questions, trying to determine the severity of her problem. Like the other paramedics, he's in his police uniform.

"It always surprises people to see cops with guns providing medical care," says Hinds. "We figure it shows the good side of what we do." The woman, clearly in no condition to fly, is placed on a gurney and rolled out to the DPS ambulance. "In this airport, nobody dies," insists Hinds. "Well, what I mean is that once we get to them and start life support, and it's usually within three minutes of the call, we won't let them die. We'll get them to a local hospital within ten minutes, with every chance in the world to live."

11:15 A.M. Karen Garver and Doddie Buschmann sit in chairs at Gate 43, waiting to greet a passenger they've never met and likely will never encounter again. They don't know his name, only that he's 16 years old, is dressed in white jeans, and is a runaway captured in Houston and on his way back to a juvenile facility in Arkansas. Of all the duties performed by the Airport Assistance Center—DFW's traveler's aid staff—few are more poignant than ensuring that runaways make their connecting flights home.

Airport Assistance hears and sees it all, from simple requests for directions to berserk passengers running naked through the terminals. The Center handles about 3,000 serious crises annually, including cases like the woman now sitting at the Center's headquarters in Terminal 2W. A Latina who speaks no English, she's with her 4-month-old baby. She has no money, no food, few diapers and arrived here with a ticket that was supposed to have taken her to Dulles International, outside Washington, D.C.

"That happens every so often," says Garver. "One of our Spanish-speaking staffers is working with the airline that made the mistake and is calling the people who were expecting her. If she's not at Dulles before the day is over, we'll get her a voucher for a hotel room, food and diapers."

The Center also weeds through "system users," or individuals who try to cadge free meals, hotel rooms or anything they can wrangle. "They'll claim they were robbed or lost their wallet or ticket," says Garver. "It's easy to see through the stories, especially when they haven't filed a police report. Also, if they ask for a voucher right off, that familiarity with the language is a good indication they're trying to work the system."

The system has finally caught up with the runaway, "Archie" (not his real name), a floppy-haired blond with a loose, splayfooted walk. Doddie Buschmann, the Center's top "crisis intervention" staffer, finds Archie in the plane from Houston and escorts him off. He's one of about 400 such juveniles she sees each year.

Nothing in the sketchy biography faxed to the Center suggests that Archie is a threat. If it had, Buschmann would call a DPS officer for backup, since youths occasionally bolt for an exit. Archie wants only a cigarette, so the women walk him to a smoking area and direct him to a chair. As he sits between them, he starts spilling his life story—of a father who wants nothing to do with him, a mother who can't handle his temper, and a desire to pick fights. In the hands of Garver and Buschmann, who keep asking questions while giving him the occasional reassuring pat on the arm, Archie is putty. For a half-hour the trio simply talk and laugh.

"Archie" makes his connection

After escorting the boy to his connecting flight, Buschmann keeps an eye on the plane until it has pulled away from the gate. Meanwhile, Garver sighs with resignation. "I asked him what he wanted to do with his life, and he just shrugged. We can't solve his or any kid's problems, and so many of them act so tough. But all they really want is for someone to listen to their story. At least for a little while, we can listen."

11:55 A.M. Bill Eustes also listens and in some cases can indeed help solve problems. Although now sitting in his office in Terminal 2W, he's usually out in the airport, tending to the spiritual needs of DFW's passengers and employees. After 32 years in the Air Force, the retired colonel is DFW's full-time chaplain. Assisted by ten part-timers, he operates a trio of chapels. Eustes considers his work a "ministry of presence."

The chapels are devoted to no particular religion.

"Redcoat" Norm Draper tries to take the worry out of making tight connections for anxious passengers.

Lady Bird Johnson gets a ride from Walt Hagan of American Airlines. Secret Servicemen are in back.

A runaway on his way back to Arkansas sits with Doddie Buschmann (left) and Karen Garver of Airport Assistance Center. They will escort him to his next flight.

Airport chaplain Bill Eustes chats with Tom Keys, the crew chief of ramp services for American Airlines.

Ingrid Dillon was the first of the now 26 passenger service agents who greet foreigners in 21 languages.

The one in 2W is frequented by several Islamic cab drivers who, about five times a day, stop in to pray toward Mecca. Eustes has put up small signs that say "East." The chapels also contain holy books from many religions that, to the chaplain's dismay, often disappear. "We can't afford to replace them," he says. "I hate to say it, but they're stolen."

1:25 P.M. At DFW they call him a legend, this gangly, 70-year-old Irishman. Ambling through the Admiral's Club, which is full of business types commandeering telephones and holding impromptu meetings, Walter Hagan grabs a taco chip and takes a quick bite, heading for his office. On the door there is a sign that reads: "American Airlines Vice President, and Special Assistant To Dolly Parton."

Hagan actually is manager of "special services." Photographs cover nearly every inch of the office walls. The portraits, with Hagan in many, include every President from Lyndon Johnson to George Bush; there's John Wayne, Phil Harris and dozens of other actors and singers, showbiz celebrities on their way through DFW. Hagan has formed close friendships with many, including Dolly Parton. "We traveled to Ireland together last year," he says. "She wanted to investigate the roots of country music, and I took her to see some of my relatives."

Dressed in a dark gray suit, with a red silk tie and a red silk handkerchief tucked into the suit pocket, Hagan sits in a chair and glances at the walls. Using the pictures as a mnemonic device, he tells stories of his many guests. "Most have the same concerns as any passenger," he relates. "I once had the king of Sweden here and asked if I could do anything for him. He seemed to have something on his mind. 'What I really need is a telephone,' he said. 'I must call the queen.' " Aside from pampering celebrities, there's a practical side to this job. "Popular entertainers can get mobbed by autograph seekers, which is not only uncomfortable for them but jams the terminals," Hagan says. "Just yesterday, for example, country-and-western singer Billy Ray Cyrus came through."

Delta flight attendants go over their assignments before heading for their plane and a hop to Atlanta.

Driving Lady Bird Johnson

Hagan excuses himself and disappears into the terminal. A few minutes later, driving a small electric cart with a fringed top and careening between pedestrians, he pulls to a lurching stop in front of the Admiral's Club elevators. Beside him, regal in bearing and showing utter confidence in Hagan's driving, however erratic, is Texas icon Lady Bird Johnson. Hagan hops out of the cart faster than the man with the short-cropped blond hair and plastic earphone. The Secret Service agent smiles with knowing chagrin as Hagan shunts him aside, grabs Lady Bird's shopping bag and ushers her toward the elevator.

2:45 P.M. The international evolution of DFW is evident as Lufthansa Flight 436 from Frankfurt arrives at Terminal 2W. More than 200 passengers, most from Europe and the Middle East, bear down on Immigration and Customs. Many speak neither English nor Texan. It was once a problem, which DFW solved by putting together a staff of bilingual Passenger Service Agents, or PSAs.

Ingrid Dillon, tall, affable and blonde, is a first-generation American of German descent; she was the first PSA to greet international passengers when the group formed seven years ago. At Immigration, most questions are routine, about where they're from, who they're visiting, the length of their stay. In Customs, things get more interesting. "It's not drugs, although Customs looks for them," says Dillon. "It's the agricultural inspection. There's a profile, and if you're an elderly person from Europe or the Middle East—and there are a lot on this flight—you're probably a suspect. The agents are looking for food smugglers."

In bringing a taste of home to relatives, such passengers pack spices and other goodies. "Cookies are usually OK," says Dillon. "But what's often confiscated is sausage. I translate and ask if they've got some hidden in the baggage. They say '*Nein, nein.*' But sooner or later, an inspector is going to pull out a string."

The elderly are also frequently perplexed by the pace and complexity of DFW's physical layout. "The job of PSAs doesn't stop at Customs," says Dillon. "We escort people into the terminal and try to get them going in the right direction. It's hard for them when they don't speak the language and can't read the signs."

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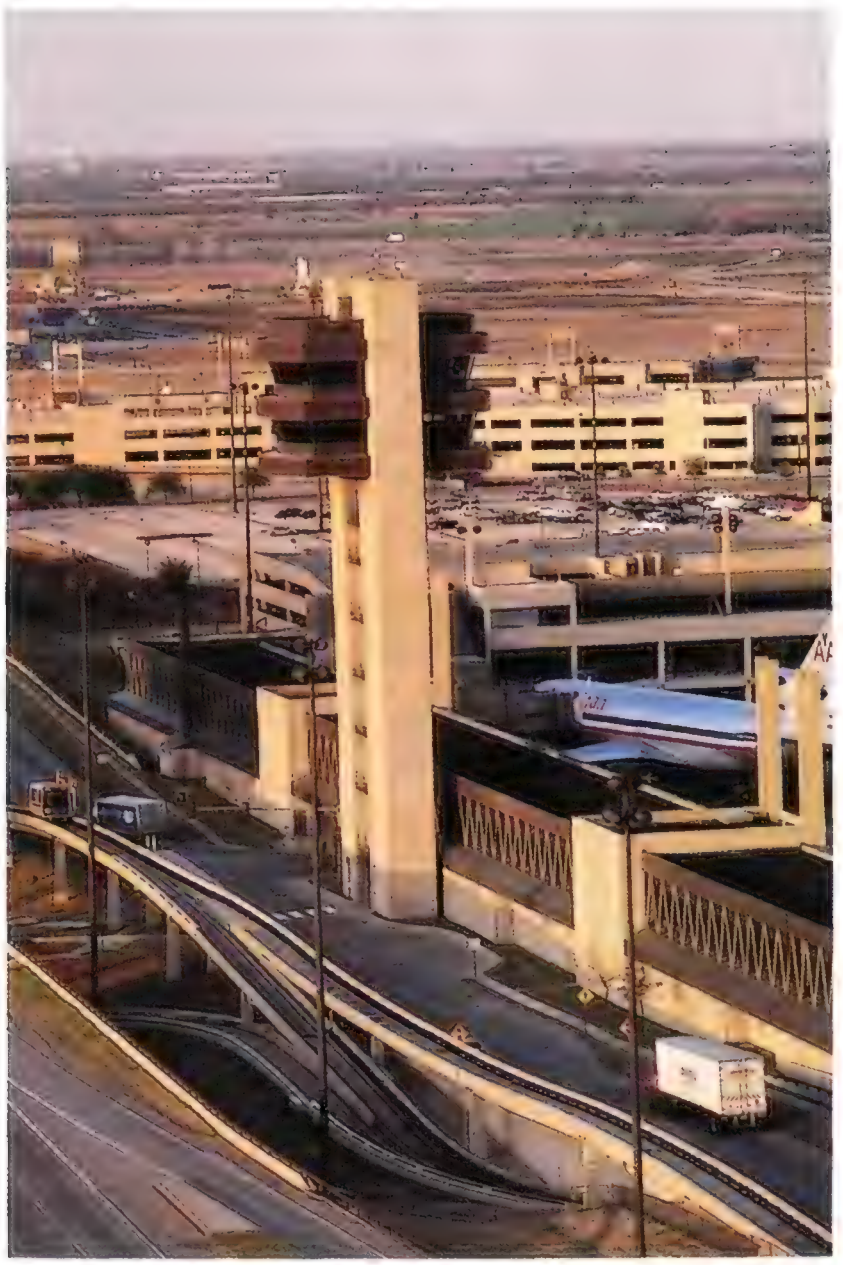

Aerial view shows only a fraction of the small city that is the airport. The electric tram is at lower left.

3:40 P.M. At ground level beneath Terminal 4E, in an area still informally known as the "stew lounge," Delta Airline's flight attendants lean over computer terminals, keyboarding madly to juggle their flight schedules with time off. In soft chairs, others talk shop and personal matters. As departure times for the next bank of flights near, the attendants for each flight gather in small briefing rooms.

One may think that in-flight service is rote and automatic, but the meeting of the crew for Delta Flight 722 to Atlanta changes that perception. Lead attendant Melinda Bailey calls the briefing to order and asks if anyone has recently worked this flight and had problems. "I was on last week," reports one, "and whoever worked the galley put all the steaks in one cart and all the chicken in the other. We had to scramble to get the right meals across the middle section."

"OK," says Bailey, "whoever takes the galley, make sure you mix it up. Do I have volunteers?" A male attendant raises his hand. Like a self-directed work team, the others divvy up assignments. "If anyone has problems, come to me for help," concludes Bailey. "And if I'm doing something that seems wrong, please let me know because I want to hear it." With that, the meeting breaks and the crew heads for the gate.

4:30 P.M. In the cavernous basement of the Hyatt Hotel, located in the center of DFW, the general session of the International Mobile Air Conditioning Association's 36th Annual Convention and Trade Show is just concluding. A speaker from Goodyear has given a talk entitled "Hose Materials for R-12 Retrofit" (the Hyatt hosts some arcane gatherings). In other parts of the hotel this day there have been meetings of the Ringling Brothers-Barnum & Bailey Circus, the Potlatch Corporation and the Whataburger chain. With 130,000 square feet of meeting space, the Hyatt—which has east and west towers—is versatile. Conventioneers can, of course, visit the Six Flags Over Texas amusement park, just seven miles from the airport. The Fort Worth Stockyards, for those inclined to bid on some beef, is 22 miles away. On airport property the hotel also maintains its Bear Creek Golf and Racquet Club, with two 18-hole courses.

"If O'Hare or JFK closes, we'll get a surge"

The hotel accepts vouchers from airlines that need housing for stranded passengers, at least 100 per night and often more. When there's an off-beat pulse in DFW's flight operations—from one plane's mechanical problems to bad weather that shuts down another airport—it's felt at the Hyatt. Each morning, in fact, bellman Ricardo Esteban checks the weather forecast in *USA Today*. "If O'Hare or JFK closes, we'll get a surge of people, and I've seen us go from 400 guests to having all 1,400 rooms full, like *that*," says the talkative Esteban, with a snap of his fingers. "Like *that*" ripples through the hotel, as check-in lines run deep into the lobby, and bellhops wrestle luggage like linebackers mauling a quarterback. Cooks in the restaurants gear up for triple the number of meals, while managers pitch in and deliver room service.

5:30 P.M. In the FAA tower, as the sun begins to set, casting a pink glow on the high clouds over the Texas sky, the evening pulse is just now being felt. "Ah, 814, you missed your turnoff," says a controller, his voice betraying only mild agitation. "Take a left at the next high-speed turnoff and hold."

During the next half-hour, 84 aircraft will arrive at DFW, and 89 will depart—almost six takeoffs and landings per minute. Throughout the early evening, the entire airport is bathed in a constant roar.

6:35 P.M. At the Lone Star Bar and Grill in Terminal 2E, travelers are knocking back drinks and chowing down on food before the next push of departures.

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After midnight, when traffic is slow, James Ward replaces one of 18,000 lights on runways, taxiways.

Here, and in a nearby sports bar, patrons are jammed shoulder to shoulder. Neither establishment looks much like an ordinary airport snack factory.

"We've been trying to make our airport establishments reflect the community in which they're located," explains Howard Shotwell, the Host Company's regional director for DFW. "Back in the 1970s, Host tried to be as generic as possible. Today when folks come to Texas, they can expect to find Tex-Mex food or a Gulf Coast seafood place. For airport food, it's really not bad."

7:40 P.M. By any standard, the Italian meals served in iL Nonno's, a restaurant in the Hyatt's east tower, are exquisite. Yet the great food is almost secondary, for every iL Nonno's waiter and waitress is a professional opera singer, and they take turns performing, along with a pianist.

"It's a most excellent gig," says tenor Pat Sniderwin. "An awful lot of singers audition for this job," explains the 45-year-old waiter, who has performed with the Dallas Opera Company and the Opera Theatre of St. Louis, as well as a number of others. "You work only four hours a night, can take lessons during the day and practice before a good audience. The management is great about time off for auditions. I just got back from a recital in Hawaii, and next week I'm auditioning in New York."

9:30 P.M. While the lobby and bars of the Hyatt are packed, Terminal 2E is silent. In fact, the Lone Star Bar & Grill, crowded an hour ago, is closing. In the passenger areas of DFW, the beat slows to a near halt.

10:30 P.M. The night belongs to maintenance and cargo. From now until the first daylight push, only four or five flights per hour will arrive or depart. Still, the pulses seen during the day are echoed in the movement of packages at the United Parcel Service's DFW Gateway facility. Considered a small hub by UPS standards, it's still served by more than a dozen large aircraft, including 757s.

"Nearly all of our people are college students who work part time," says Gateway manager Tom Whitmore. "They're trained to be very careful; we don't drop or even set packages into the cargo containers, we 'place' them. And the ones that don't fit into containers, what we call 'irregulars,' get special attention."

The 10 P.M. to 4 A.M. shift is getting down to business. Pilots will soon arrive for the first flights out, with guaranteed overnight cargo. Some of the big metal containers will not be unpacked and sorted; they were already prepared at another facility for routing through DFW. Like people, they wait for a connecting flight.

12:15 A.M. On Runway 13 right and 31 left, electricians Bruce Hipple and Jim Ward are working fast, replacing burned-out "touchdown zone" lights. White bulbs set in round metal plates that fit flush into the concrete, these are part of the 18,000 lights that illuminate DFW's runways and taxiways. At the end of 13 right is a portable set of lights in the shape of an X, which is supposed to warn any pilot who might inadvertently try to land on the closed runway. Says Hipple, "We still keep our heads on a swivel."

In a pickup truck that tows a trailer filled with replacement lights, the men are moving more swiftly than normal, mainly because of a Weather Service report of a Level 4 thunderstorm set to roll across the sprawling airport within an hour. Hipple and Ward don't mind working in the drizzle now falling, but when lightning starts blowing holes in the concrete, they must get off the field fast.

Pulling up to a burned-out light, Ward jumps out, grabs a power wrench and removes the bolts holding the plate in place. Hipple then prys it out with a long screwdriver, unhooks the electrical connection and snaps in a plate with a fresh light. Ward secures it, and within two minutes the men are on their way to the next one.

"I'm biased when I say we do a good job"

The pair belong to a 422-member maintenance staff that takes care of DFW's lights, runways, roads and other infrastructure. These days there's a lot of concrete work, as DFW's 20-year-old runways approach the end of their structural life. "I'm biased when I say we do a good job," says Fritz Renfro, the airport's maintenance director. "But I'll tell you just one thing. I go to bed every night without a single worry about our systems. I trust that everything will work and never lose a minute of sleep."

2:15 A.M. Occasionally a traveler provides comic re-

lief for the crew at the AIRTRANS maintenance station at the far south end of the airport. "Sometimes it's a passenger who doesn't understand the announcement that the car they're in is going out of service," says Reggie Simmons, a former Marine and now a maintenance controller. "Often it's someone who's dozed off and wakes up when we go in to clean the car. We usually drive them back where they belong." Tonight that would be merciful; outside is a downpour.

3:00 A.M. If the rain hadn't subsided, only the crazy would be out on a DFW runway at this time of night. But an important operation is under way: removing rubber from the runways. A truck that looks like a space beast is moving along at three miles per hour, shooting a three-foot-wide swath of high-pressured water into the concrete. The blast, a continuous 22,000 pounds of pressure, erupts into a mist.

"We've got to do this two or three times a year," says Renfro. "The rubber builds up to about an eighth of an inch thick, and with rain gets slippery. With the deicers we use on the runway during freezes, it's even worse. For safety, we've got to get the rubber off."

4:15 A.M. Richard McGee is a "line equipment operator." Earlier, he'd driven a large sweeper behind the rubber-removal vehicle. "It's pretty weird when you finish sweeping up and go dump the contents," he says. "It looks like a million melted, black rubber bands." Now McGee is in a smaller sweeper truck, traversing DFW's streets and parking lot. "Not exactly a glamour job, is it?"

Of that you can be sure. And yet, it's work that by night makes DFW a more pleasant place by day. Still, one could argue that this is the airport's most pleasant hour. Except for the whoosh of the sweeper brush, no other sounds pierce the air. Without the roar of jet engines, DFW is eerily quiet.

6:35 A.M. "Tower port, this is one-ten," says Curt Kuehner from his yellow station wagon. "Please show Runway 18 right and 36 left as closed."

"Roger, one-ten, we show it closed."

Kuehner pulls the yellow wagon out onto the runway for an inspection. The first pulse of the new day will start in about 20 minutes. Landing lights are visible on the horizon, and jets are already starting takeoff rolls on other runways. The rhythms are beginning for another day at DFW.

An arriving jetliner flies over the array of visual and electronic apparatus that defines the glide path. During a half-hour period, as many as 84 aircraft will land while another 89 depart on six major runways.

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By Michael Kernan

A national memorial bears witness to the tragedy of the Holocaust

A new museum in Washington, D.C. opens to exhibit the lessons of history as a testament to the dead, and a reminder to the living

How do you think about millions?

Stand in the morning fog at Auschwitz II, the killing camp known as Birkenau, and everywhere around you are chimneys, all that is left of the barracks where the inmates were kept, for the Nazis burned down many of the sheds as the Allies approached. The rough wooden barracks were designed as stables, but each was packed with more than half a thousand living skeletons. Once each building had a wood stove with a crude heating system, hence the chimneys, but little heat was provided for these prisoners.

The dark brick chimneys loom up in the mist, row after row after row, as far as you can see. Dozens, scores, hundreds of them, marking the last shelter of a thousand people and then of a thousand more when the first ones died of starvation or a bullet or the gas chambers, and then of a thousand more, and then of a thousand more. And perhaps as you begin to understand, to grasp the meaning of a million, of six million, you begin to comprehend the Holocaust, this thing that the human race did to itself.

On April 26 the United States Holocaust Memorial Museum will open in Washington, D.C. Mandated by a unanimous act of Congress in 1980, it stands on 1.9 acres of land given by the federal government between 14th and 15th Streets just off Independence Avenue and the Mall. The five-story building contains 265,000 square feet of space. Dedication ceremonies will be held April 22.

The money for the structure and its 36,000-square-foot permanent exhibition, a fund that will total some $168 million, comes from private donations obtained by the Presidentially appointed 55-member United States Holocaust Memorial Council.

It is a monument to remembering, with a mission "to tell the full, horrible truth about the Holocaust," according to Harvey M. Meyerhoff, the council chairman.

But any memorial dedicated to the Holocaust presents a unique problem. The dilemma is that this event must be spoken of—yet must remain unspeakable. It must never be allowed, as Nobel Peace Prize winner Elie Wiesel has said, to become ordinary, to be absorbed into the normal fabric of human history.

A vanished world comes alive in tower of photographs of Jewish life extinguished in Polish town of Ejszyszki.

Photographs by Robert C. Lautman

Neoclassical lines of curved limestone face of museum's 14th Street entrance (above) relates building to nearby monuments, serves as screen to street. Facade is counterpoint to the industrial steel-and-brick construction.

"There are those who believe the story of the Holocaust cannot be told, that only those who were there can understand," says Michael Berenbaum, the museum's project director. But, he adds, there are things that must be learned, for though the Jews were the central victims, the lessons of this tragedy are universal. "History has imposed upon us the responsibility of telling the story of the Holocaust."

Even before the building was designed, objections were heard from some who thought such a memorial did not belong in America, so remote from the death camps of Eastern Europe, or in Washington, whose politicians in 1939 had rejected the refugee ship *St. Louis*—sending its passengers back to almost certain death—or especially on the fringes of the Mall, with its cheerful folk festivals and upbeat museums of American accomplishment.

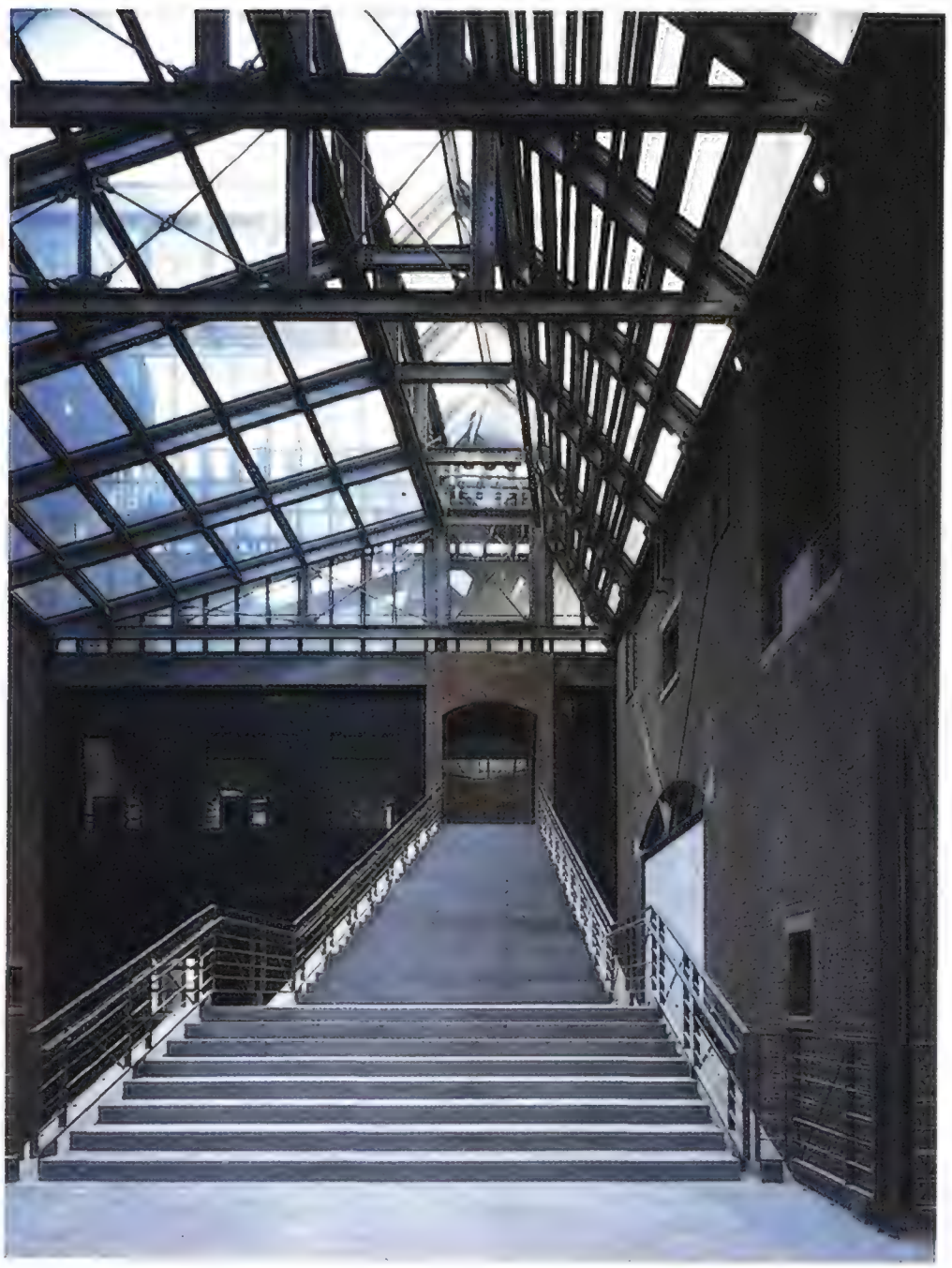
As for the concern that the museum might be too grim for that site, museum director Jeshajahu Weinberg has this to say: "It is not morbid. It is an historical museum devoted to a world-shattering event in which the United States was very deeply involved. And beyond the American aspect, this was an event in world history that has implications and moral lessons for all humankind."

The Holocaust, he notes, was basically a racist event—"racism taken to its climax. Everybody who goes there will ask the question: 'How would I have behaved?' It is a major moral question that we face almost daily in our lives. Jews happened to be the major victims of that event, but it is certainly relevant for everybody."

Originally the Holocaust Commission, appointed by President Jimmy Carter and headed by Wiesel, considered a monument similar to other emotion-laden Holocaust memorials all over the world, even at the camps themselves. But the final recommendation was for a historical museum to inform as well as to remind.

Wiesel, an Auschwitz survivor and author who perhaps more than any other living human has come to personify our struggle to cope with the Holocaust, resigned in 1986, after getting the project launched, to make way for someone more versed in fundraising,

The author, a frequent contributor, was a teenager during World War II. He visited Auschwitz a few years ago with a friend who escaped the camp in 1943.



Glass wall (far left) of one of bridges linking museum's towers is etched with endless list of names of Holocaust victims. At right, steel girders and glass ascend from tapered stairway, brick arches, of Hall of Witness.

design and construction. He plans to attend the opening ceremonies.

As it was, the demands of designing the building almost defeated architect James Ingo Freed, a principal in the firm of Pei Cobb Freed & Partners and a Jewish refugee who fled Germany in 1939 at the age of 9.

"I gave myself three months to plan it," he said recently. "I didn't know that much about the Holocaust, so I immersed myself in reading and films. My wife got so depressed she moved out of the bedroom. Nothing came to me. Should the building try to tell the story? Should it be poetic?"

He asked himself: How would the structure relate to the other buildings on and near the Mall? Could it? Should it? He would be asking the casual tourists of summer in their shorts and funny shirts to shift abruptly 50 years into the past, to confront an ugly world they might know little about, nor care to have their children see.

The months passed. Freed was on the point of giving up, when he decided to visit the camps in person. He saw what was left of the ovens at Auschwitz, with their manufacturer's plaques proudly displayed. Tramping through the mud of the Polish camp, he found his shoes flecked with bits of human bone.

"Finally I began to respond. I wanted to convey the feeling of constantly being watched, of things closing in. I was thinking of the Warsaw ghetto. The bridges that the Jews had to cross over to get from one part of the ghetto to another, so they wouldn't contaminate others. I wanted the feeling of a procession. Of choices: either/or. Selections. The long lulls and sudden bumps forward, the steps to death."

His solution to the problem is brilliant. The massive facade on 14th Street has a grave beauty, a solemnity that imposes its mood on the passer-by. The succession of towers down the flank suggests the march of the years, leading back to the Hall of Remembrance, a six-sided memorial to silence, a place where visitors can meditate on what they have seen.

Subtly, in certain slightly off-kilter features, the building evokes a world of dislocation, a world askew. To those walking through it, the vistas seem disorienting. Perspectives are forced. Diagonals don't always appear quite right. The framework of the 304 large glass panels of the ceiling of the central Hall of

Photomurals and video monitors document the reign of terror that accompanied Hitler's rise to power.

Witness is skewed, twisted, the way the wreckage at the camps was crazily wrenched by fire, the way the world had become twisted.

For those who have seen Auschwitz and the other places, specific visual references are everywhere. The tapered staircase leading up from the ground floor looks weirdly like the famous perspective shot of the railroad tracks at Birkenau with the arch looming above, a familiar picture to anyone who lived through the '40s. The brick walls contain decorative curved lintels, echoing the grim shape of the oven doors. Steel braces set into the walls recall the braces that the Nazis had to install to reinforce the brick of the ovens because of the extreme heat.

This is very much a public place, and for some, the building may just be too huge, too imposing, too grand to speak for the terribly private experience of death. For some, it may instruct but not move to tears as does, say, the memorial in Paris. But to most visitors, who haven't been to the camps, the Holocaust Memorial Museum can be a tremendous awakening experience.

The heart of the experience, of course, is the actual process of the visit itself.

As I enter the museum I pick up a computer-generated ID card of a Holocaust victim. Every visitor will get such a card. My new identity is Arthur Menke, born 1927—the same year I was born—in Hamburg, Germany. His father owned a small rubber-stamp factory.

Now I take an elevator to the fourth floor to begin a long, winding journey down through three floors of exhibitions. The experience actually begins as the steel doors of the elevator snap shut. The recorded voice of a liberator from the U.S. Army tells of coming upon the camps and of the horror he found there. A video monitor runs footage of the liberation. When I arrive on the fourth floor, the elevator doors open on a large photomural of G.I.'s entering a camp.

Armbands, frozen bank accounts, closed schools

As I wend my way past murals and exhibits the story of Hitler's rise to power in 1933 is thrust at me. The gradual increase of legally sanctioned government pressure on the Jews is demonstrated. In his great documentary novel *The Wall*, about the Warsaw ghetto, in which a half-million Jews were literally walled in, John Hersey listed the sequence: "casual looting of Jewish property; kosher slaughter forbidden; *Kehilla* [the traditional Jewish community council] disbanded and *Judenrat* [Nazi-sponsored Jewish leadership] formed; public worship forbidden; census; registration for labor . . . armbands; bank accounts frozen; limitations on change of residence; registration of Jews' jewelry; schools closed; restrictions on travel; registration of property; Jews barred from trolleys and buses . . . wall sections built . . ."

There is an exhibit on the systematic racism practiced by the Nazis, the obsession with physiognomy, eye and hair color, caliper measurements of head proportions, nose length, cheek width, forehead height, to prove the superiority of "Aryans." Also on display is a Hollerith machine used by the Nazis for the national census. Benign in itself, the elaborate tabulating device, sort of a punch-card computer, was put to sinister use classifying citizens by race and religion, thus making it easy for the Nazis to identify and locate Jews and other "undesirables."

The Nuremberg Laws of 1935, legalizing the war against the Jews, are described, as is the 1938 Evian Conference, called by President Franklin Roosevelt to deal with the international refugee crisis brought on by Jews fleeing Germany and Austria. Basically, the 32 nations at the conference turned their backs on the refugees. A hotel register shows the names of diplomats who attended the conference.

Suddenly my progress is stopped by a horizontal bar, like those used at European borders. I can see beyond the bar but have to detour. My movement is controlled.

As I walk to the left, there are artifacts from Kristallnacht, November 9, 1938, when in a government-orchestrated national frenzy of hate, hundreds of

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Jewish-owned stores, schools and synagogues were smashed and burned, and scores of Jews beaten and killed. Here is a wooden Torah ark from a German synagogue, slashed with maniacal fury. The sheer energy of the hatred visible in these gouges is appalling. There are Nazi hate posters and books like *The Poison Mushroom*, which infected small children with hatred of Jews; and an actual Gypsy wagon from Czechoslovakia, to symbolize the attack on other minorities, from homosexuals to Jehovah's Witnesses.

Inexorably, I am moving forward. There seems to be no turning back. I am a witness as the fear builds among the Jews of Germany. A number manage to flee the country, a few find ways to fight back.

As I continue, I insert my ID card at a computer station and am given a first-person update on Arthur Menke. I find that the Nazis have seized his father's business and that the family has been moved to another part of town. "My sister and I make our own 'Nazi' flag and hang it out of the window," the boy says. "But my parents get angry with us and reel it back in. We don't understand why we can't support our own country."

Now I walk across a bridge—a glass floor, a change of footing and a view down onto the central skylit concourse through a glass wall etched with the names of 5,000 European towns and villages and shtetls that were attacked or simply obliterated by the Nazis—and through a tower hung with hundreds of photographs of men, women and children from one such town.

Stairs lead down to the third floor, which covers the most horrific phase of the Holocaust, 1940-44. Now the surface beneath my feet changes disconcertingly from granite to cobblestone to wood. This is another device meant to disorient—to upset the visitor's sense of order and rightness and logic. Here are the murals of ghettos and ghetto life, and a casting of a section of the wall that surrounded Warsaw's Jewish sector. The gate of the Jewish cemetery from Tarnow, Poland, is also here, as are photographs of Theresienstadt, the Potemkin Village camp set up by the Germans in western Czechoslovakia. The faces shown here bear little likeness to the smiling workers and happy children depicted in Hitler's propaganda film about the camp or to the staged scenes he arranged for a Red Cross inspection to quell rumors about the mistreatment of Jews. In reality, Theresienstadt was nothing more than a way station to the death camps.

The exhibits grow more and more terrible. Some may be so hard to take that special walls hide them from child visitors. One of the freight cars (left) that was thought to have transported Jews and others to their deaths stands alongside a wooden platform. Found on a remote siding in Poland, the car was presented to the museum by the Polish government. Visitors can enter the car, walk right through it to the other side, or choose to detour around it. I walk through.

Near the train car are samples of the mountains of ordinary possessions confiscated at the Birkenau siding from the thousands who were marched straight from the railroad cars to the gas chambers—toothbrushes, combs, mirrors, kitchen utensils, suitcases—some of them with names carefully painted on: Josef Rederer, Ida Pollak, Julius Simon, Oskar Popper . . .

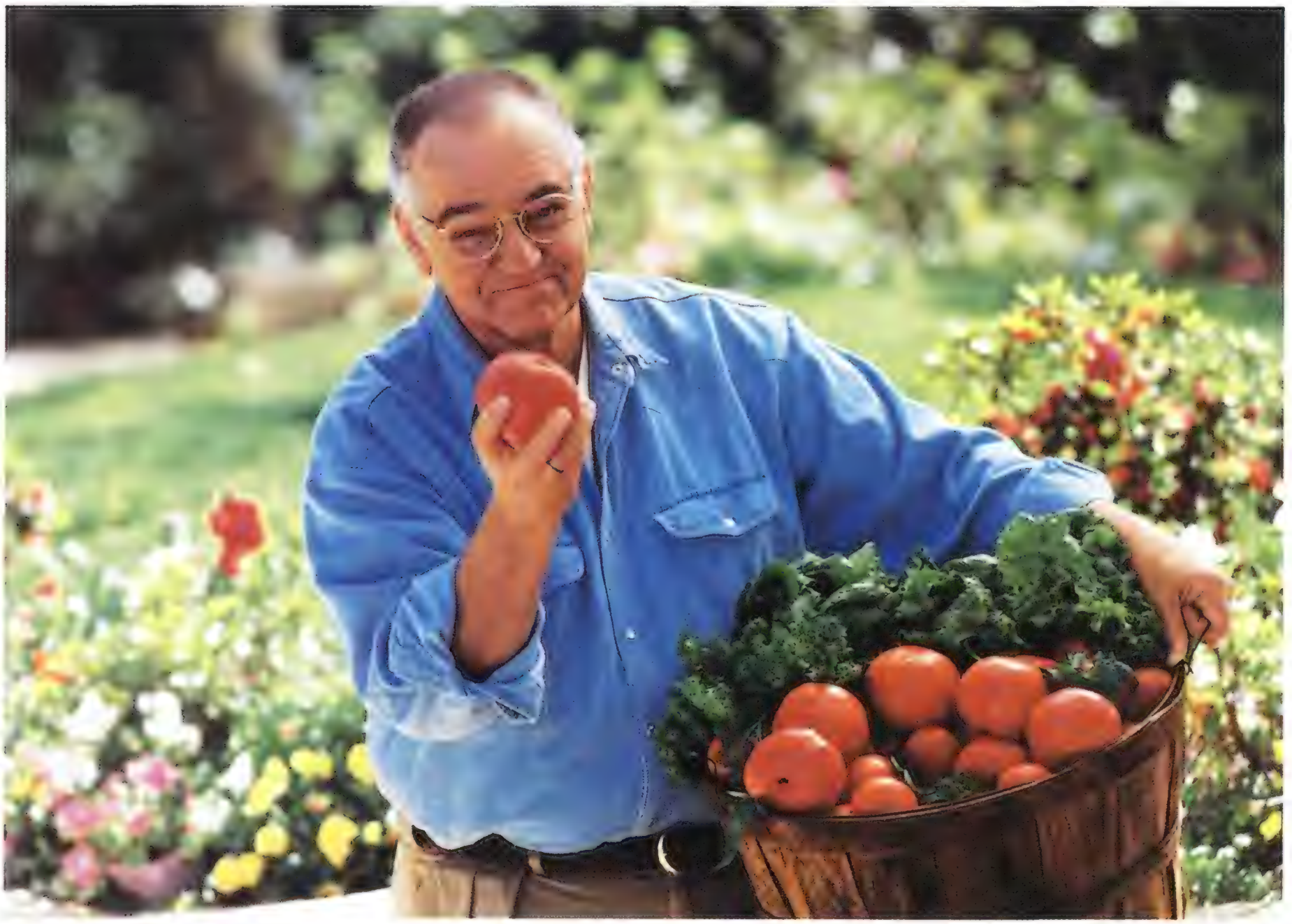
A barracks from Birkenau, a gas chamber door

I move on, walking under a casting of the notorious iron "*Arbeit Macht Frei*" sign over the entrance to Auschwitz, a bit of heavyhanded Nazi humor, telling the prisoners that work would make them free. Part of an actual barracks from Birkenau is here, and a casting of a gas chamber door and canisters of Zyklon B, the toxic gas used for the killings. There is a pile of stone blocks from the Mauthausen quarry, where inmates were forced to work and sometimes pushed to their deaths by SS guards. And there is a mesmerizing sculpture by Polish artist Mieczyslaw Stobierski depicting, with hundreds of small white plaster figures, the whole

Boxcar found outside Warsaw was kind used by the Nazis to transport victims to the concentration camps.

Richard Dysart

Gardener, Actor



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Richard Dysart

Miracle-Gro

process of selecting, gassing and burning at Auschwitz.

Among the vast trove of images is one of Janusz Korczak, the Warsaw orphanage director who marched with his charges onto the deportation trains, though he could have escaped. His story has been celebrated in books and movies, but it is necessary to remember that hundreds, perhaps thousands, of unsung mothers also rejected the offer of life in the camps and chose to die with their children.

Amazingly, the museum has one of two milk cans (right) in which historian Emanuel Ringelblum buried his archive of the Warsaw ghetto. The second is in Warsaw. The museum has collected 23,000 such artifacts, filling two warehouses—remnants of the nightmare. Some are as ordinary and nondescript as ID cards and prayer shawls; some are as elaborate as the intricate model of the Lodz ghetto (opposite), complete with all the streets and bridges, built inside a sort of violin case by Leon Jacobson and later buried in the Polish ghetto. After the war, Jacobson's brothers found the model in the rubble of the ghetto and returned it to him. He in turn has given it to the museum.

From all over the world, people have donated items that once meant everything to them: a doll (opposite) from the Krakow ghetto (the girl who owned it ended up in Buchenwald, was liberated and later reunited with the doll, which was left behind in Krakow and saved for her by non-Jews), a mica necklace, a frayed old cloth belt that Ruth Meyerowitz, now of West Orange, New Jersey, found in the dirt when she was a 13-year-old at Auschwitz and wore, though such decorations were forbidden, and cherished for years afterward until she thought to give it to the museum.

Stacks of propaganda and execution notices

Though the museum has not specifically sought out Nazi paraphernalia, a few important items are in the collection, including stacks of propaganda, execution notices, medical instruments, and geneticists' measuring tools, one with a brass nameplate: Dr. Eugen Fischer.

I sit down at a rest point and listen to recorded voices of survivors telling what life was like in Auschwitz-Birkenau. I think of Bergen-Belsen and Buchenwald and the thousand other places from France to Russia. There are bowls from the camps here, 4,000 shoes, a picture of the hair of 40,000 human beings on exhibit at Auschwitz. Here, too, are castings of a door from an Auschwitz oven and a zinc dissecting table used to salvage valuables, such as gold fillings, from the dead.

Continuing my tour, I once again cross over a bridge, this time with a glass wall etched with the first names of victims, and then on to the other side and through the bottom level of the tower of snapshots.

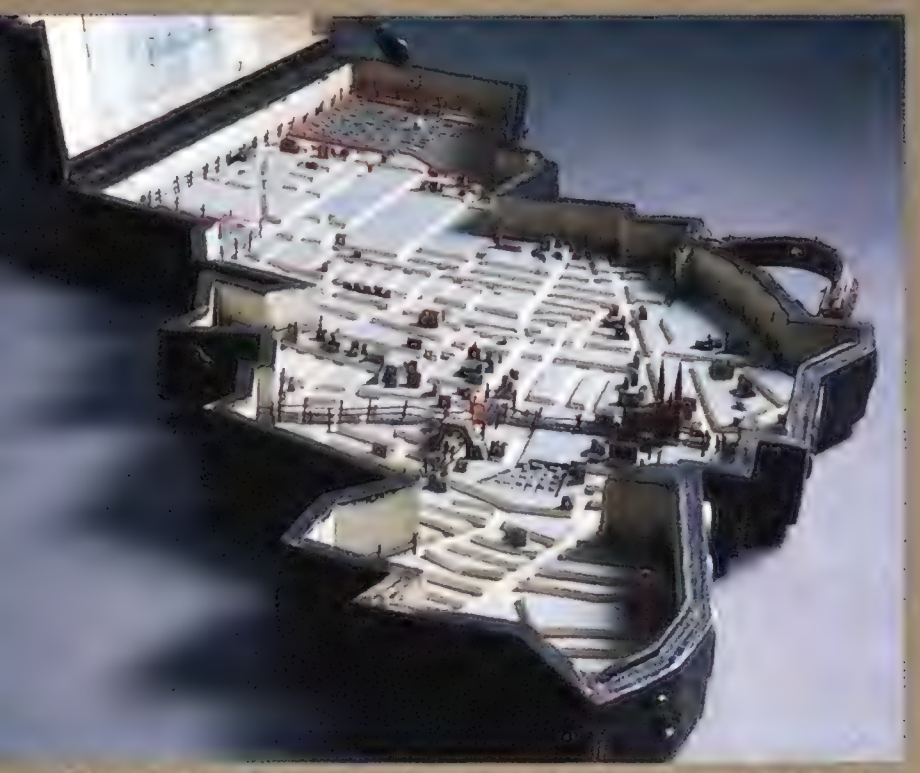
And here surely is the most powerful single exhibit in

The means: canisters once held pellets of Zyklon B, the deadly insecticide used in the Nazi gas chambers.

The record: milk can buried in the Warsaw ghetto preserved secretly kept documents.

The desecration: inscription on sacred Torah ark of German synagogue was defaced during Kristallnacht.

The badge: purple triangle on death camp uniform branded wearer a Jehovah's Witness.



The ghetto: Leon Jacobson meticulously crafted scale model of Lodz ghetto during his confinement there.

The keepsake: doll saved in Krakow ghetto belonged to Zofia Burowska, who survived camps, found doll.

the museum. A woman named Yaffa Sonenson Eliach was 4 years old when the Jewish population (some 4,000 souls) of her Polish town, Ejszyszki, was wiped out in 1941 by the guns of the mobile death squads, the German *Einsatzgruppen*, forerunners of the more efficient gas chambers. Only 29 survived the massacre, Eliach and her immediate family among them. Now living in Brooklyn, she has spent much of her life collecting some 6,000 photographs, a family album of her shtetl. Most of them are reproduced here, some discolored, some bent and cracked, all of them unspeakably moving in their portrait of a lost world.

A grandfather, a small girl, a baby

Many are studio portraits, for Eliach's grandmother was one of the town's photographers, and Eliach and her brother managed to retrieve some of her photographs after the war. Most of the images, however, were painstakingly acquired by Eliach from friends and relatives of the victims. Four sisters pose together, all of them handsome, one a stunning beauty. They wear pleated skirts, slingback heels and '30s hairstyles. Here is an old bearded grandfather and a small girl in a white lace dress wearing a locket. (Where is that locket today?) Two men in Polish uniforms, the hats too big for them. A dashing youth with cigarette in mouth, riding a bicycle through the woods. A baby in a sled. The family Glombocki standing before a house of unpainted rough wood. Five boys in Zionist scout uniforms, dated June 10, 1930. The Portnoy sisters, clear-eyed, standing with a vase of roses. Eliach herself as a wide-smiling small girl feeding the chickens. Wedding parties, school groups, young couples smiling dreamily, schoolboys in knickers, with clipped hair. Snow scenes in unknown cities, summer scenes with leaf and shadow. A girl standing in a broad field holding three eggs. A boy with bangs in an embroidered shirt, chin in hand, the other hand resting possessively on a typescript as he looks intelligently at us, staring straight at us, into the future. His nails are dirty. You can multiply these pictures by a thousand, but you don't have to. By themselves, they say what has to be said.

Down now to the final floor of the tour. I learn that Arthur Menke has been deported to a giant ghetto in Russia to cut blocks of peat for fuel for the German Army. "The soldiers are regular army and don't abuse the prisoners as badly as do the SS here," he reports. "Walking to and from our labor site, I push the guard's bicycle for him. Food is so scarce that one day he locks me in the potato cellar so I can steal potatoes for him. He allows me to take some for myself."

After two years in Minsk, Arthur Menke was deported to Poland and in 1945 was liberated while on a forced march to Dachau. (Some ID cards record the

Washington Monument rises up behind succession of towers and glass bridges of museum. Brick-and-steel construction has industrial look, echoes images from the Holocaust. For some the towers suggest death camp watch towers; bridges recall elevated ghetto walkways.

holder's death; others testify to survival.) On this floor I learn about the Jews who fought back. Trees from the Rudniki forest in Lithuania that provided a haven for partisans tell of their resistance. One of the small fishing boats by which the Danes ferried many Jews to safety in Sweden is here. And a vendor's sign from Lidice, the Czech village wiped off the face of the Earth in retaliation for the assassination of Reinhard Heydrich, the executor of the Final Solution. At the end of the hall is a row of photographs, the killers, the mass murderers—the perpetrators of the Holocaust.

Finally there is a reprise of the role of the liberators. The conquering Allied armies were the first outsiders to enter the death camps, though escapees had been coming out of Europe for years to tell the terrible story, and aerial photographs clearly showed the prison barracks and the transports.

Now I move out of the exhibition area and into the 70-foot-high Hall of Remembrance, lit by a domed skylight and a few tall slivers of windows. The walls seem to stand unsupported, the glass gaps between them reminding one of the thin shafts of light in the barracks. The symmetry of the space stands in sharp contrast to much of the rest of the museum, restoring a sense of order and calm and comfort. Candles may be lit and left in niches. There are steps for people to sit on, in the quiet.

Earth gathered from the camps and ghettos of Europe has been buried in one area beneath the hall's floor. An eternal flame will sit above the spot.

The problem of how much to beautify this solemn memorial has been with the designers from the beginning. "Most museums deal in the beautiful," Michael Berenbaum has said. "We are dealing with the anti-beautiful." "The tragedy cuts through all the time—in nightmares and in speechless anger and incomprehension," adds Raye Farr, director of the permanent exhibition. "But we go on trying to make it visible, even if we can never explain why it happened."

Some of the artwork that embellishes the walls and open spaces comes straight from history, like Roman Vishniac's celebrated photographs of Jewish life in Eastern Europe before the war. Some has been specially commissioned. Notably, four artists—Ellsworth Kelly, Sol LeWitt, Richard Serra and Joel Shapiro—have been asked to create sculptures or wall drawings for the museum's public spaces.

Then there is the Children's Wall of Remembrance, which features 3,300 ceramic tiles painted by American schoolchildren in memory of the 1.5 million children lost in the Holocaust. The Tile Project, started by educational advocate Adeline Yates in 1986, is part of the museum's campaign to teach elementary school pupils about the event.

Children are a special concern at the museum, and an exhibit titled "Remember the Children" has been set up for those ages 8 and older. It follows a composite child named Daniel through the Holocaust to his eventual survival. His room, toys and furniture are there in replica to be touched and studied. A similar children's show, with photographs but no artifacts, has been traveling around the country as part of the museum's outreach program, which is considerable.

Along with the four classrooms of the educational center, there are two exhibition galleries for temporary shows and two auditoriums on the lower levels—in

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It was an unlikely alliance. But when five state governments, two wildlife conservation groups and one energy company came in with concern and came out with solutions, it seemed more inspired than unlikely, after all.

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addition to the small auditoriums that are part of the permanent exhibition. These larger chambers, seating 414 and 178 respectively, will be available to the public for performing arts events, films, concerts and lectures.

In the computer-based Wexner Learning Center on the second floor, visitors can work some of the museum's 24 interactive computers to call up tapes of survivors telling their stories, or to study in detail specific aspects of the Holocaust, such as Swedish attaché Raoul Wallenberg's rescue of thousands of Hungarians—often literally ordering them off the deportation trains by simply reading out names in a loud voice while the Nazi guards gaped, so imposing was his presence—until his disappearance into the Soviet Union.

On the top floor are the library and archives, occupying 16,000 square feet of space. In addition to a 20,000-volume library, the facility contains a huge mass of Holocaust records, including reels of microfilmed documents stored in a special climate-controlled room. The collapse of Communism brought to the museum an immeasurably valuable collection of captured German and other material from the former Soviet Union and Eastern Europe. The library and archives, along with the museum's oral history, photography and film collections, constitutes the United States Holocaust Research Institute, which is expected to develop into an international center for Holocaust scholarship.

One important aspect of this scholarship is the continuing search for information about the dead, so many of whom simply disappeared without trace. People want to know, if possible, just what happened to their lost families. Once in a great while, survivors from the same family are reunited.

Nazi records of deportation trains, lists of names for work details, transport lists, camp death books (complete with fictitious causes of death: "pneumonia" or "shot trying to escape"), documents on euthanasia—the handicapped were the first to be eliminated—kept with insane meticulousness, are being catalogued by the museum in cooperation with the National Archives, which holds much of this material. As the museum sifts through these records, it coordinates with the American Red Cross to identify documents that may be helpful in tracing Holocaust victims.

The American Red Cross has been tracing lost people for years, since the Civil War in fact. A special unit set up in Baltimore two years ago has accepted more than 13,000 tracing requests connected to the Holocaust and has reunited survivors in some 100 cases.

"We work with the museum to increase people's awareness of this service," said Diane Paul, director of the Red Cross unit in Baltimore. "So many were totally forgotten. These records prove they existed."

The Red Cross also coordinates with the International Tracing Service in Arolsen, Germany, which holds 46 million such documents relating to more than 14 million people.

Some Nazi records give not only the victim's name, and place and date of birth—unreliable because many lied about their age to survive—but occupation and religion, and sometimes the name of the SS officer responsible for that person's death. Some of the people listed in the Mauthausen camp death book were U.S. citizens. A few were captured American fliers.

The staggering job of finding individual names in this sea of handwritten lists from all over Europe is just one of the projects of Holocaust researchers.

And unfortunately, tragically, such work today is not the quaint, musty, abstruse thing that scholarship can be. Taking note of the ominous resurgence of racial strife around the world and of neo-Nazi activity in Germany and elsewhere, the museum's deputy director, Elaine Heumann Gurian, says, "It is frightening to think about the relevance of our museum. I think we would have liked to be less relevant."

On the other hand, one remembers the words of a Polish tailor named Ignacy Kunin, who died just a few years ago. A Jew who made it to America after surviving five years in Auschwitz, Buchenwald and three other places because of his skill, a man who once, in order to stay alive, made a sky-blue uniform for the ineffable Reichsmarschall Hermann Göring, Kunin was a wire-tough, sardonic survivor who escaped death-by-selection a dozen times in the crazy lottery that was life in the Nazi camps: "I consider it was a victory. I consider that we won. Hitler is gone, and we're still here."

The apparatus of death: handle and peephole of a gas chamber door, cast from one at a Polish camp.

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MY STARS! IT'S EATING A BIG MUCK!
Huehnergarth

By James D. Snyder

Off-the-shelf bugs hungrily gobble our nastiest pollutants

The cleaners of environmental messes are now turning from brute force to a stealth strategy: enlisting nature's invisible army

Oily water, contaminated soils, toxic residues leaching from landfills, nuclear wastes—these days we seem to be lost and befuddled in terrain filled with disagreeable and dangerous stuff. How, we ask ourselves, are we ever going to clean up this awful mess we have made?

Well, something is quietly eating away at that problem even now: bugs. Bacteria, to give them their proper name—legions of them. From sewage plants and oil spills to contaminated streams, muscular microbes are at work, digesting the nastiest pollutants and producing mainly water and carbon dioxide.

If anything good emerged in the wake of the *Exxon Valdez* oil spill in March 1989, it was the highlighting of the potential of bioremediation, a term that means employing microorganisms to restore natural environmental conditions. But it didn't happen instantly. In their first desperate efforts to save the 900 miles of affected shoreline, cleanup crews scrubbed individual rocks and stones, knowing that they couldn't really hope to reach the oil that had seeped between cracks and under gravel.

Next, they tried hosing the oil off beaches with hot, pressurized seawater. While the high-powered blasts cleansed boulders and helped provide breathing room for a few large animals, those closer to the bottom of the food chain—snails, clams and barnacles—were cooked by the high heat or smothered when the beach was churned. By early summer, crews noticed that the few untreated beaches were beginning to show signs of returning to the picture-postcard environment that existed before the spill turned Prince William Sound into a black lagoon.

In Washington, D.C., meanwhile, the Environmental Protection Agency (EPA) was fielding calls and letters from members of a fledgling industry. Manufacturers and packagers of specialized bacteria—then numbering no more than perhaps 50—were asking for a chance to unleash their troops.

Unlike most of the "native" microbial strains that live in the ocean, the bacteria they offered used oil as a food source. Extra nutrients—usually nitrogen and/or phosphorous—are added at the work site to stimulate the microbes' metabolism and make them eat more voraciously. Once they do so, their only "wastes," besides water and carbon dioxide, are fatty acids that are in turn eaten by plankton and other organisms.

Bioremediation wasn't on the EPA's list of officially approved remedies for oil spills, however. After two months of wrangling, a specially convened scientific panel agreed to a limited test on one secluded beach. The ground rules: nutrients only; no "outside" bugs and no private manufacturers. Instead, an EPA-Exxon team sprayed ordinary liquid farm fertilizer (containing nitrogen) on a cobblestone beach plot.

A clean rectangle on an oiled beach

The test began that June. As the EPA later reported: "Approximately 2 weeks after the [liquid] fertilizer was applied to the cobblestone beach plot, scientists observed visible reductions in the amount of oil on rock surfaces. To the scientists who surveyed the test plot by helicopter, it looked as if a clean rectangle had been etched on the beach's surface."

Not so for an untreated area south of the test plot. "It remained considerably contaminated," said the EPA, "suggesting that nature alone could not account for the dramatic reduction of oil observed in the test area."

The bug makers were heartened. If ordinary ocean bacteria and farm fertilizer could do all that, then surely the EPA would recognize the potential of specially chosen microbes and more-potent nutrients. But the EPA cautiously spent the rest of the summer on more fertilizer tests. The following summer, when commercial microbes were finally admitted for field tests, the sun had pretty much set on the *Valdez* cleanup and the chance for any widespread bioremediation. Yet, the big Alaskan spill was a watershed event both for the EPA and for bioremediation. The agency has since assigned the National Environmental Technology Applications

One organism's poison is another's staff of life; the right microbes will eat just about any toxic waste.

Illustrations by John Huehnergarth

Corporation (NETAC)—a research group spawned by the EPA and the University of Pittsburgh—to develop and standardize protocols for treating specific types of spills, such as open sea and shoreline.

"Until the *Valdez*," says NETAC president Edgar Berkey, "there was a knee-jerk fear of manufactured [industrially grown] microbes, probably brought about by too many movies like *The Blob That Ate Detroit*."

The EPA also changed a key policy. Previously, it had insisted that any technology used at one of the 1,200 waste-contaminated Superfund sites on its "nation's worst" list be certified as "Best Demonstrated Available Technology" (BDAT). Because incineration can destroy 99.99 percent of most organic wastes, it was invariably chosen over all other forms of treatment—even when others promised to cost much less. Biotreatment obviously takes more time and usually isn't more than 95 percent effective. But it's so much cheaper that the EPA is now urging staffers to stress "innovative technologies." Today, more than 200 EPA-policed cleanup sites use biotreatment.

Antibiotics kill beneficial microbes in cow stomachs. Would adding "bugs" to feed restore things to normal?

All that progress would delight and surprise George Jefferies. Jerry Bower, too. In the early 1950s, Jefferies, an inventor from Salem, Virginia, was intrigued by the fact that bacteria retreat into a spore form (a sort of suspended animation) whenever they face hostile conditions such as extreme heat or cold. Live spores have been found in the chambers of Egyptian pyramids.

Jefferies' contribution was to patent a way to make microbes go in and out of this "suspended" state almost on cue. Thus, he reasoned, they could be grown and then packaged and inventoried until needed. But commercial uses were limited to such routine chores as treating septic tanks and clogged drains.

Jerry Bower might have fared the same if it weren't for luck and pluck. By 1958 Bower was already a successful inventor thanks to his patent on the first plastic bread wrapper. A friend told him about a feed-additive salesman with an idea and no money. Ed Noeker, who sold animal antibiotics, often heard farmers complain that the antibiotics in his feed pills also tended to kill the naturally occurring microbes that help a cow digest her food. Why not develop another additive made of cultures taken from a cow's rumen? Once back in their warm, moist natural home, the bugs would snap back to life and rekindle the digestive process.

Bower had no sooner agreed to invest in the scheme when he suffered two setbacks. First, Noeker, the partnership's technical expert, died unexpectedly. Then university researchers determined that the cultures wouldn't work as a feed additive.

"Rather than give up, Jerry immersed himself in the business," says the man who bought him out in 1980, R. B. (Jones) Grubbs, the president of what is now

Scrubbing rocks by hand after an oil spill could become a thing of the past. It may be that microbes can do the job better, faster and cheaper. The time has come to try.

Solmar/InterBio in Orange, California, recalls that Bower tried variations of the formula for everything from cleaning restaurant grease traps to retarding the deterioration of corn stored in silos. What kept him going was a vision that large-scale sewage-treatment plants would one day accept bugs to help break down sludge. Today they do. "But at the time, sewage plants were getting so many calls from guys with 'miracle' chemicals that he was dismissed as another snake oil salesman," says Grubbs.

Then came Lady Luck, in the form of the *Queen Mary*. The venerable ocean liner had just been towed into nearby Long Beach harbor to be transformed into a floating hotel, only to be rebuffed by the grossest of indignities. "The local fire department said her bilges were so full of oil and tar they were a firetrap," Grubbs recalls. "One of the city councilmen knew Jerry and asked about the chances of his formula working on petroleum. Well, it was awfully primitive compared to what we use today, but he went aboard and dumped in a few boxes. In three days the volatile gases were gone, and within six weeks they were able to discharge the contents of the bilge right into the harbor with no toxic risk whatever."

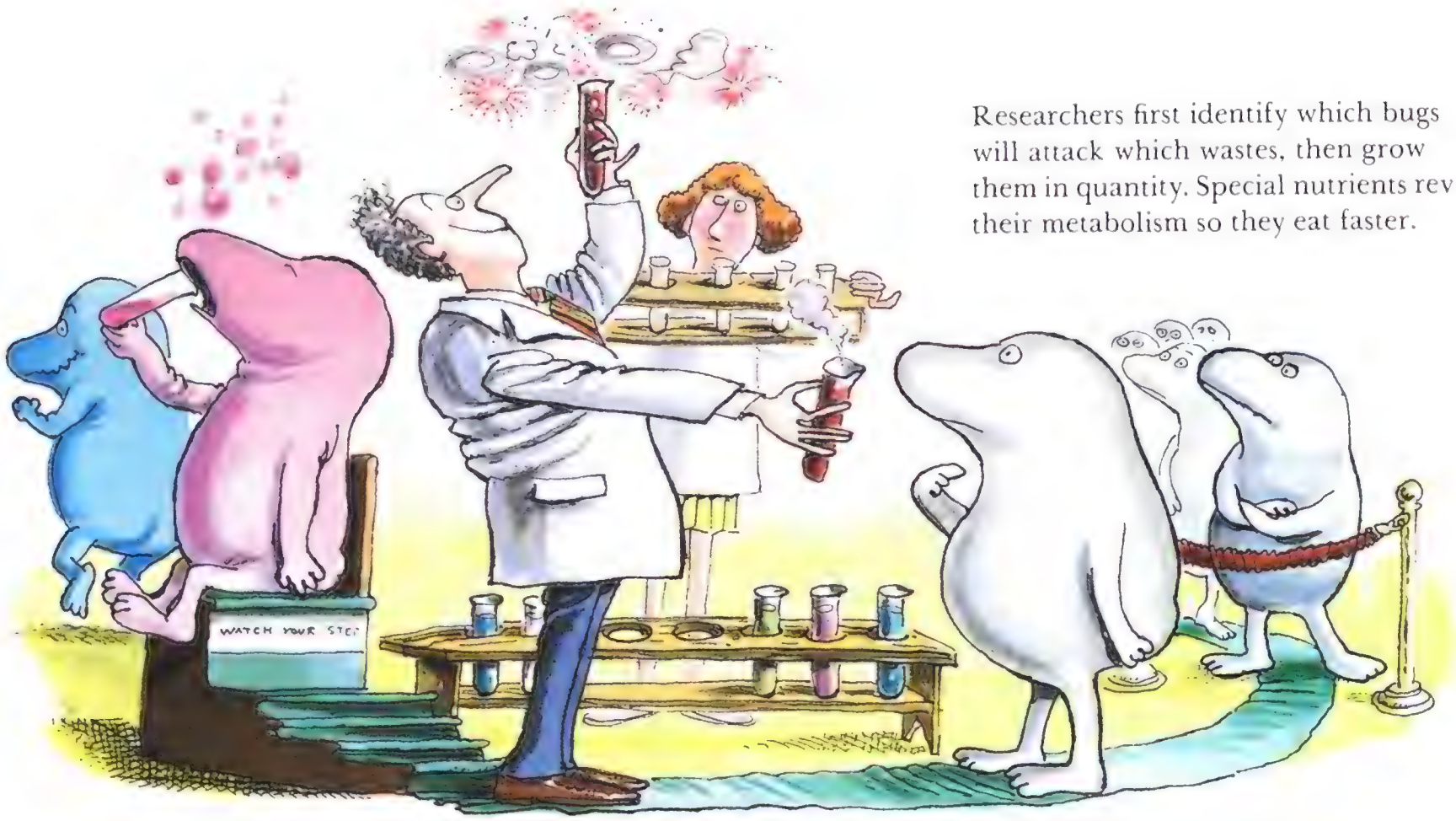
Today, Solmar sells 26 formulations, and it's not unusual for some manufacturers to offer 40. Off-the-shelf formulas resembling dried herbs—usually sold in bags or drums—are designed for such uses as eating animal waste, keeping ponds free of algae and cleaning up gasoline leaked from service station storage tanks. Moreover, bug makers are getting into brand-name advertising and packaging with names like Oil Spill Eater, Alpha Biosea, Marine-D and Bioblend.

Some companies guard their formulas zealously. Carl Oppenheimer, a former University of Texas microbiologist turned manufacturer, talks with the fervor of a big-game hunter as he describes junketing from Russia to Antarctica to Italy collecting microbes renowned for their oil appetites. All are blended, he says, with a special secret nutrient. (It has been rumored that the additive is simply ground from dried cow pies, which, of course, are treasure troves of nitrogen and phosphorous.)

Jones Grubbs says he uncovered a "terrific" product for treating animal wastes because he "just happened to be visiting a pig farm one day and saw this lovely pile out behind the barn. It looked like peat moss and was absolutely odorless," he says. "But the farmer told me it had started out as plain hog manure. Now if you know what hog manure smells like, you'll know the

Peat moss and microbes in a composting toilet mean no sewers and a harmless residue good for gardens.

The author is chairman of Enterprise Communications Inc., and editor in chief of Environment Today, *a newsmagazine for industrial environmental managers.*



Researchers first identify which bugs will attack which wastes, then grow them in quantity. Special nutrients rev their metabolism so they eat faster.

instant respect I had for these particular bugs. I felt as if I'd just discovered some superstar athletes."

But just how do you get one bug to work on oil and another on animal wastes? "It's sort of like drafting a bunch of guys for a football team," shrugs Grubbs. "You try 'em out on the field until you've seen which ones play what positions the best. Take any sample out of the ground and you'll find a consortium of different bacteria at work. In that hog manure, for example, we isolated maybe 25 different types in the lab, then used some standard tests to identify the one type that was the real workhorse."

Finding the Right Stuff is crucial, of course, but there's much more to drafting microbes for the war on wastes. Some bacteria exist only in aerobic conditions (where oxygen is present) and need constant churning, or aeration. Others work only in anaerobic (oxygenless) surroundings, such as the kind that feed on sulfur compounds and give off that infamous rotten-egg smell (hydrogen sulfide). "One of the main reasons people seek out firms like ours," says Grubbs, "is for bugs that don't produce odors."

With other firms, what's salable may be a special nutrient or something else added to the basic formula. Last year, for example, Lockheed Missiles & Space Company announced a "breakthrough" oil slick remedy. The microbe strain involved is actually found in natural seawater, but an additive of powdered clay helps coagulate the spreading oil and keep it from sinking, and a nitrogen fertilizer excites the microbe's appetite.

As bug makers refine and expand their formulas, the range of new applications is growing as well. For instance, the type of bacteria that tamed the farmer's manure pile does the same for the human version in a flushless toilet. Sold by Planit Services Inc. of Kelowna, British Columbia, for use in rural vacation homes and worksites, the ToileTronic resembles a conventional toilet except that its only link to the outside is a pipe leading to a ceiling vent. Below the seat, a stainless-steel chamber contains peat moss, which can hold twice its own weight in liquid. When the toilet is in use, a fan vents odors up through the ceiling pipe while an automatic rotator mixes the peat moss and human waste. Thanks to a built-in aerator (ever the key to keeping aerobic bugs robust) the result is what Planit's Raymond Perry calls "a harmless, virtually dry residue." A typical family of four, he says, can collect a month's worth of residue in a shoebox-size plastic bag and "toss it in the garbage or sprinkle it on the yard."

The same basic concept works on a grander scale for the Palm Beach County Solid Waste Authority in Florida. Faced with dwindling landfill space and a state law that mandates recycling 30 percent of its waste by 1994, the county recently opened a $1.3 million facility to compost some 30 tons a day of sewage sludge and yard clippings. One of perhaps 20 like it nationally, the Palm Beach facility features four 250-foot-long troughlike bays under one roof. There, automation helps microbes munch out in minimum time. An agitator mixes and moves the waste materials down the long bays while blowers force air through them to keep the bugs frisky. The result, 21 days later, is an almost odorless, fluffy soil conditioner that the county uses on its own parklands and sells to garden shops.

The beaches here are great, but the sand castles are fantastic.

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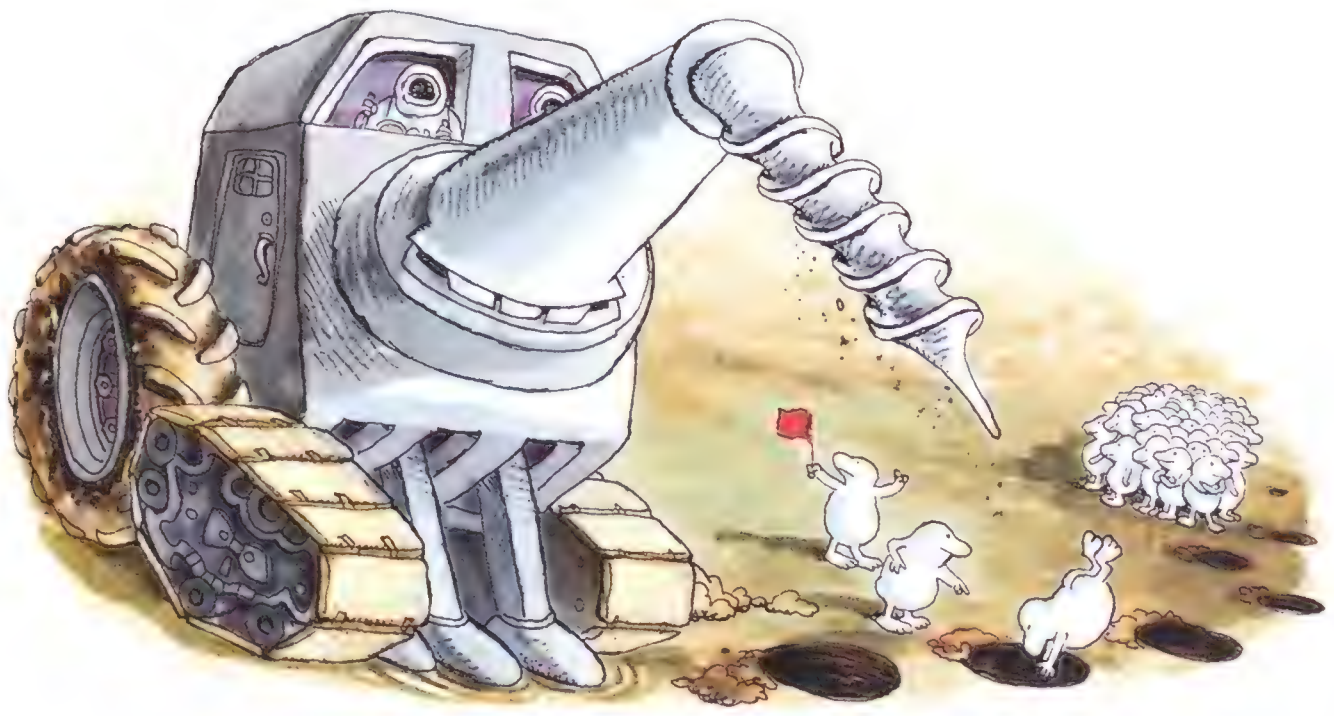
Small businesses are beginning to discover microbe muscle as well. Until passage of the tough new Clean Air Act (CAA) amendments in 1990, the only toxic industrial emissions policed closely by federal regulators were those from potentially big troublemakers like paint and pharmaceutical manufacturers. Today, the CAA is forcing thousands of bakeries, printers, dry cleaners, auto body shops and others to filter out fumes deemed to be volatile organic compounds (VOC).

Some VOC control systems can cost $1 million-plus to install for a company that might not gross that much in a year. One cheap alternative, already flourishing in Germany and the Netherlands, is ideal for facilities that face moderate—but not severe—VOC emissions or odor problems. The gases are routed outside the building, humidified and channeled through a sort of horse trough that might run 100 feet in length. Positioned along the bottom are aerators. Piled on top are peat moss, wood waste or compost—loaded with bacteria. As the vapors seep up along the filter bed, target pollutants become a wet film covering the filter particles. Once trapped like that, they're attacked by the bugs and converted to the usual CO_2 and water.

Still, the big show for bioremediation is the hazardous waste cleanup site, usually one of the 1,200 falling under the EPA's $10 billion Superfund program. It may belong to an active petrochemical complex; it may be an abandoned "midnight" dump site or a former hazardous waste landfill teeming with everything from drums of solvents to discarded electrical transformers. Before the *Exxon Valdez* spill, the closest thing to large-scale bioremediation work was "land farming," in which a petroleum refinery would dump piles of oil wastes out on the south forty and churn them every so often to provide aeration. Time simply wasn't a factor in completing the job. Today, it's very much on the mind of every Superfund site manager who has to worry about pressure from local environmental action groups or how long he can afford to keep his leased equipment. His reaction to bioremediation is usually, "Thanks for the bugs. Now how can we make them work even faster?"

The upshot has been perhaps a hundred ingenious innovations. To wit, one way to make bacteria work more efficiently is to control their conditions. A cold snap, for example, can make bugs left in groundwater as sluggish as the rest of us. But pump the contaminated water up into a large heated tank and you can make it as hospitable as a cow's tummy. This bioreactor also allows you to monitor the rate of consumption and add nutrients or new bacterial battalions if needed. BioTrol Inc. of Chaska, Minnesota, has installed its patented bioreactor at several sites to remove everything from solvents and gasoline to the nasty wood preservative pentachlorophenol. BioTrol's reactor is filled with a highly porous packing material to which the microbes adhere. When air is supplied in the form of fine bubbles, the bugs are positioned like spiders to trap and dine on anything that floats by.

Typical EPA nightmare: an underground gas plume of volatile organic compounds threatens to waft into an aquifer that supplies drinking water. Conventional treatment calls for sinking small shafts, perhaps in the hundreds, to trap the VOCs and route them to expensive extraction equipment. But it's time-consuming and still leaves much of the VOC mass underground. Another way: dig a few narrow wells and force air through them. Underground, the VOCs are forced to rise to the surface, where most are captured via extraction wells. Meanwhile, the hollow spaces beneath the surface, now filled with fresh air, become dining rooms for bacteria. Bugs and nutrients, pumped in through the same air wells, serve as a sort of janitorial crew by filtering out the remaining VOCs.



Augers drill holes in polluted soil, then inject microbes and nutrients. The dirt is detoxified for one-fourth, or even less, of the cost of digging it up and burning it.

Dry Jack
When fresh, it's best for melting or grating. If it's sweating, cracking, and hard, it's best used as a doorstop.

Langres
A spicy cheese best eaten without bread, without crackers, without fruit, and most important, without the skin. The latter is too pungent for consumption.

Fougeru
Creamy, ripened in bracken leaves. Taste by pressing to palate with tongue. (Beginner's tip: Remove leaves first.)

Become a cheese wiz.

Sage Derby
Green-marbled, with lovely sage flavor. Like cheddar, it's good for sauces, soufflés, and (would you believe?) tacos.

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Tender, smells of goat, with a deep blue mold skin, dusted with charcoal. A treat for the bold.

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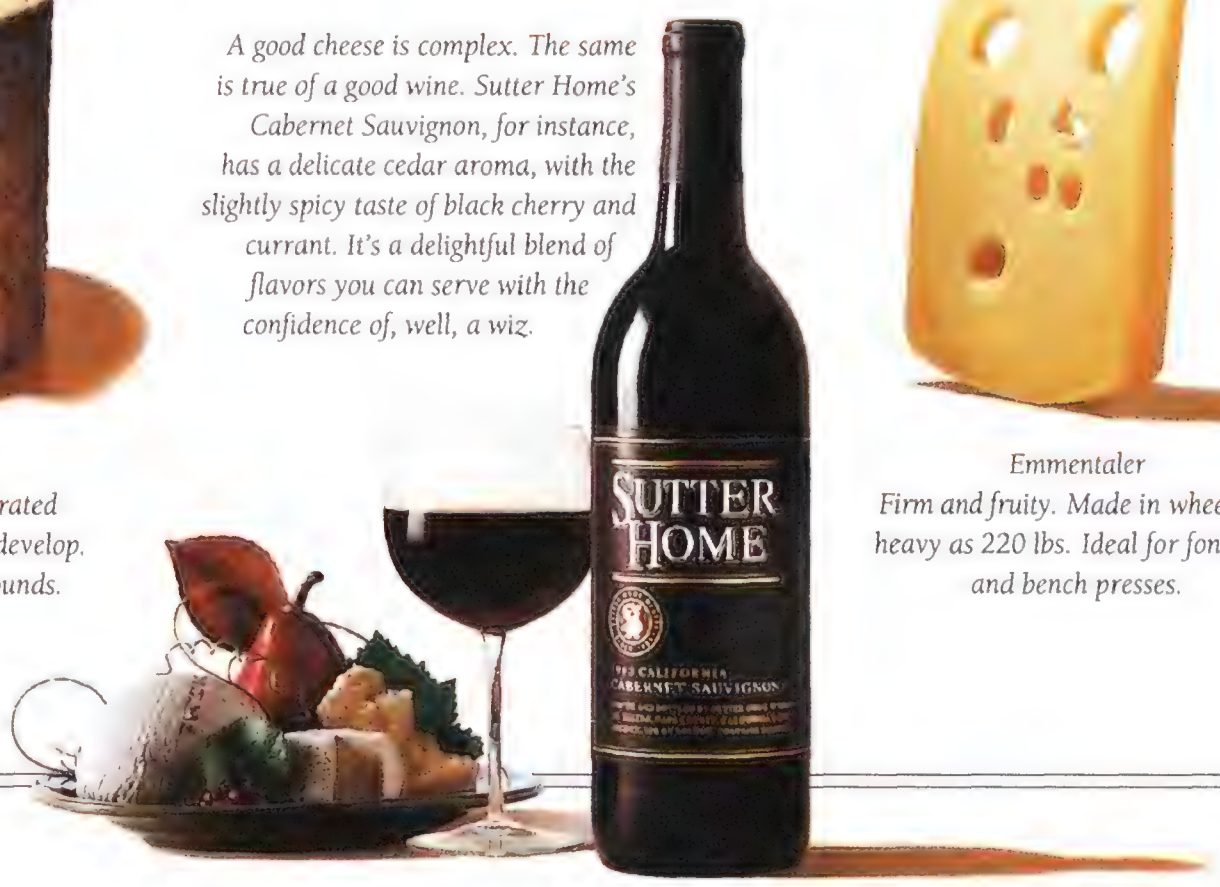
King of the English Blues. Perforated with needles so veins of mold can develop. Tastes infinitely better than it sounds.

A good cheese is complex. The same is true of a good wine. Sutter Home's Cabernet Sauvignon, for instance, has a delicate cedar aroma, with the slightly spicy taste of black cherry and currant. It's a delightful blend of flavors you can serve with the confidence of, well, a wiz.



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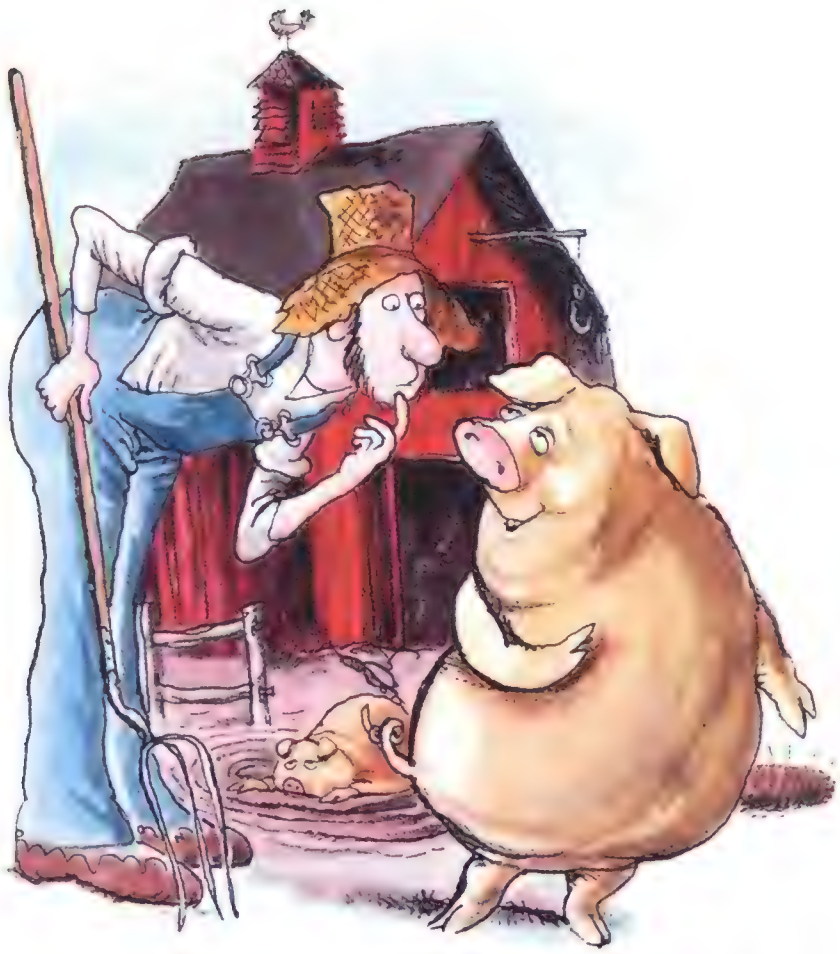

A microbiologist found a pile of pig manure that had become odorless fluff; he knew he was on to something.

Suppose the pollutants aren't in groundwater but imbedded deep in the soil. In remediation's medieval period—say pre-1990—conventional wisdom called for excavating the toxic soil and trucking it off for incineration, often at $400 a ton. Today it's possible to treat the soil in place for $80 to $100 per ton with technologies like the one used by In-Situ Fixation of Chandler, Arizona. Its five-foot-diameter twin-auger system consists of a pair of oversize drill bits fixed to a tractor for easy access to job sites. As the augers twist to depths of more than 100 feet, they inject and homogeneously mix in a potion of microbes and nutrients that have been poured down their hollow shafts.

As these and other innovative bioremediators establish their speed and cost effectiveness, the more they're spurred on to tackle more chemically complex forms of pollution. "Over 90 percent of the chemical substances classified as hazardous today can be biodegraded," contends Tom Zitrides of Bioscience Incorporated in Bethlehem, Pennsylvania. At an Air Force base near Fairbanks, Alaska, a remediation team is bioventing jet-fuel-saturated soil. The ECOVA Corporation in Redmond, Washington, employs bugs in a bioreactor to attack creosote (the tarlike wood preservative) found throughout 100 acres that had been home to a lumber-treating plant. General Electric and others are making headway in harnessing bugs to destroy polychlorinated biphenyls (PCBs), used in liquid form to insulate pipes and electric transformers until they were banned as carcinogenic in 1977. Lab tests have even shown promise in destroying such public enemies as zinc oxide, a common byproduct of electroplating, and TNT, which is strewn all over military proving grounds.

Just how big can bug cleanups get? Perhaps the largest project to date is the 40-acre site laden with Bunker C marine fuel that ECOVA took on near Los Angeles. By churning and aerating some 300,000 cubic yards of the thick, gooey stuff in stages that took ten weeks each, the contaminant levels gradually dropped 85-90 percent.

The midnight dumpers' toxic cocktail

More typically, a site may contain a smorgasbord of contaminants, challenging bug makers to brew teams of different microbes. When Allegheny County, Pennsylvania, earmarked 1,200 acres for its newly opened airport terminal, they included 4 acres that had been capped after being strip-mined in the 1890s and then used as a municipal garbage dump for another 50 years. When Waste Stream Technology (WST) and Sevenson Environmental Services won a contract for the cleanup job, they soon discovered that the alleged household-waste landfill had also been visited by anonymous industrial dumpers in the wee hours. "We found 15 compounds," says WST president Mike Barnhart. Typical of their initial levels were a horrific 21,300 parts per million (ppm) for oil and grease; 8,200 ppm for naphthalene (the main ingredient in mothballs until banned); 1,900 ppm for xylene (a paint and gasoline ingredient); and 480 ppm for the solvent toluene.

The remediators brought out a trailer-mounted bioreactor that, says Barnhart, "allowed us to ferment different formulations as if we'd been back home in the laboratory." After the soil was dug up and tilled by mixing in bugs, air and nutrients, Barnhart watched it change "from a black, refuse-filled soil to a brown, highly cultivatable soil with a much-reduced odor."

Within two months, naphthalene, xylene and toluene had all been reduced by more than 98 percent, and oil and grease by more than 80 percent. Why the difference? The first three groups all have simple molecular structures like small bubbles—bite-size snacks for bugs. Oil and grease have long molecular chains that stretch a meal to several courses. Even so, the remediated levels are considered low enough to keep the oil and grease from migrating to streams or deeper soil levels.

But the possibilities don't end there. Researchers are already exploring the outer edge of the microcosmos and finding awesome prospects for further restoring the natural order of things. Here are three areas already showing progress:

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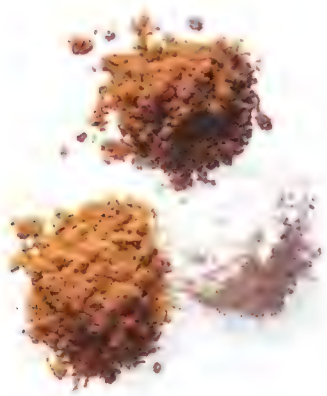

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• Microbes can make some compounds more "user-friendly." Although coal may be our most plentiful fossil fuel, most of the nation's vast Eastern reserve can't meet clean air standards because it emits too much sulfur when burned. The aromatic compound dibenzothiothene (DBT) clings tenaciously to hydrocarbon molecules and becomes sulfur dioxide when ignited. But just recently the Chicago-based Institute of Gas Technology patented a bacterial strain that eats the DBT (90 percent of it so far in lab tests) while leaving the hydrocarbons intact.

• Microbes can be genetically engineered, reducing the need for toxic chemicals. In the fall of 1991, the EPA approved the first genetically engineered pesticide. Called Cellcap, it incorporates a gene from one microbe that produces a toxin deadly to potato beetles and corn borers into a thick-skinned microbe that is hardier. Even then, the engineered bacteria are dead when applied to crops.

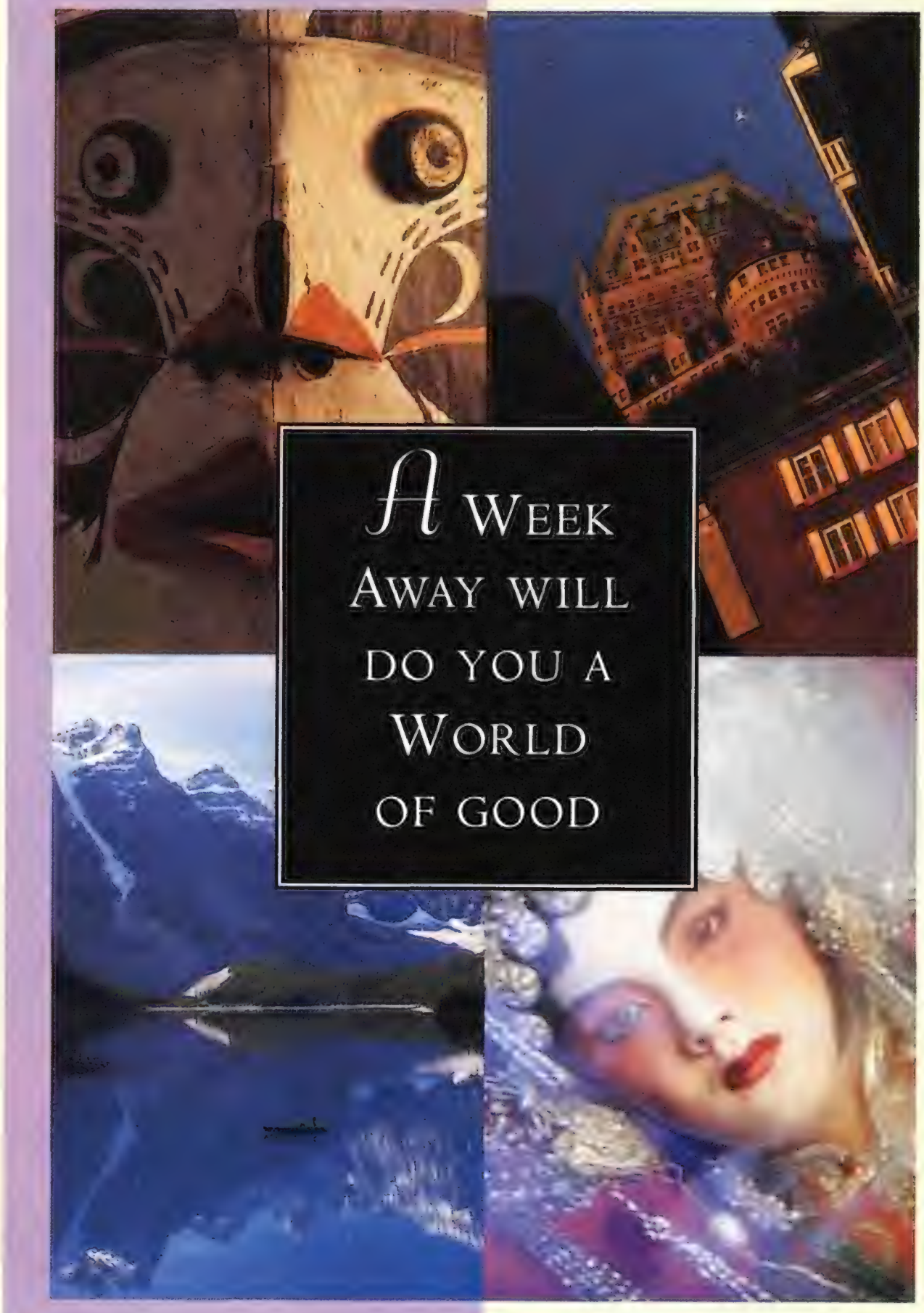
• Microbes—in roundabout ways—can help attack stubborn metals and radioactive wastes. Microbes have been used for decades to concentrate copper and nickel in low-grade ores. Now scientists are exploiting the fact that if certain bacteria are given special foods, they excrete enzymes that in turn break down metals and minerals. Researchers at the U.S. Geological Survey, for example, found that two types of bacteria turn uranium from its usual form, one which easily dissolves in water, to another, one which turns to a solid that can be easily removed from water. They may be able to do the same for other radioactive inhabitants of the global waste pile.

Ironically, the benefits of biotreatment seem to be bypassing that king of all trash heaps, the municipal landfill. The reason is that the warm and wet environment that bugs like isn't compatible with conventional landfill wisdom. We line trash pits with layers of polyethylene to prevent leakage into aquifers, then cover them each day to keep neighbors from griping about odors. The result, of course, is that you can still read newspapers dumped in 1951 (SMITHSONIAN, July 1992).

That, too, may change. A few innovators are designing wetter landfills so the bugs can do what they do best. In the process, the microbes produce methane, the chief ingredient of natural gas, which can be captured for use as a cheap, clean energy source.

Bioremediation is still in its infancy, and there is no telling how far it can go. Genetic engineering, by which the best features of several bugs would be combined in one, could multiply the potential benefits. Whatever happens, it appears a safe bet that microbes will be the Marines of future environmental cleanups.

A few good microbes are often all it takes to clean up even the most nightmarish midnight-dump pollutants. Unseen armies are at work everywhere around us, turning toxins into carbon dioxide and water—for free.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Where every day brings something different, and a week makes all the difference in the world. So have a look. We've put this book together, complete with routes to follow, to help you come to know us.

Coast Awhile.
Our seaboard provinces evoke a sense of simpler times. Ride the tides, poke about the capes and coves, watch a whale breech, or see sunrise at Campobello.

Savour the Flavour.
Québec's Old World grace and charm are unmistakable. Along cobblestone streets, in chic boutiques, by a roadside shrine, or a night on the town. Everywhere, cuisine reigns supreme.

Trip your Imagination.
Hear the cry of the loon, the roar of our Blue Jays, the thunder of Niagara Falls. Play by our lakes, or pop up for our plays. And, see the autumn leaves set gorges aglow. Just imagine.

Are you up for R. & R.?
Relaxation is second nature in our wide open spaces, where perhaps the only ones jumping are the trophy-sized fish. Try trekking the tundra, with infinite vistas and endless daylight.

Reach your Peak.
Look out atop mountains. Look over a glacier. Look up the legends carved into totems. Rainforest or Rockies, hoodoos or hoedowns, it's all very, well, enchanting.

Trains and Boats and Planes
and Great Hotels.
Weekend, week or longer, we've travel packages that make getting here a snap, and your stay a delight. From outstanding train trips to coastal cruises. With a host of folks on line here to please you. Read on!

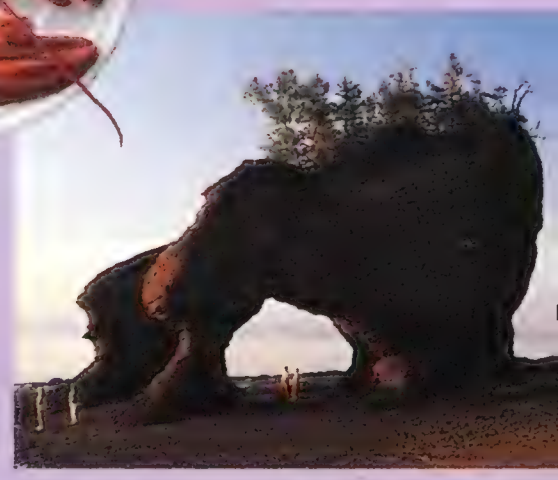
Watch out for finback and pilot whales! Be on the lookout for eagles, seagulls, and cormorants, and guillemots!

Experience the Great Days of Sail ... in sailors' museums and on board the famous schooner Bluenose II.

Visit Peggy's Cove in Nova Scotia and see why it's called the most picturesque community in all of Canada.

Reserve a room at a country inn. Then go cycling. The people are friendly – and so is the scenery.

Feast your eyes and your appetite! Succulent lobster dinners are served on Prince Edward Island and elsewhere. (Bib and butter are provided!)



Walk the beaches between the tides and see the mammoth 'flowering-pots'...the Hopewell Rocks, near Moncton, N.B.

COAST AWHILE

CANADA'S FOUR ATLANTIC PROVINCES ARE A WHIFF OF SALT AIR AND SEA-BREEZE TO VISIT ... ALL SIDE BY EACH SO YOU CAN HOP, SKIP AND JUMP FROM PLACE TO PLACE.

Say 'Hi!' to Halifax. The historic capital of Nova Scotia offers museums, galleries, shops, and oh-so-friendly people. Nearby is picturesque Peggy's Cove, and the orchards of the Annapolis Valley. Springhill boasts the Anne Murray Center. Cape Breton Island follows with the skirl of the pipes, the genius and humanity of Alexander Graham Bell, the grandeur of Louisbourg and the Cabot Trail vistas.

In New Brunswick golf at St. Andrew's-by-the-Sea. Tour Campobello, F.D.R.'s beloved summer home. Amble along the paths of the 17th-century Acadian Historical Village ... the elm-graced streets of the stately capital Fredericton.

Prince Edward Island is the pastel little island of your dreams. Anne of Green Gables plays on in Charlottetown. Province House enshrines our nation's birth; the Confederation Centre of the Arts features island arts and crafts. Nooks and coves are here ... and dunes to explore along Blue Heron Drive.

A ferry or a short flight takes you to rugged Newfoundland. In St. John's, the capital, meet the convivial Anglo-Irish merchants of Water Street. Drive the achingly beautiful Avalon Peninsula in a single day. See where Leif the Lucky landed. Marvel at the fjords and inlets of Gros Morne National Park. At the village of Trinity, be prepared to whale-watch!

Bring along your camera. And your appetite: lobster dinners at St. Ann ... salmon at Tangier ... Digby scallops ... Malpeque oysters ... cod tongues and screech ... delicate fiddleheads and dulse ... a few of the mouth-watering specialties of Canada's ocean playground.

HERE'S A GREAT LITTLE TOUR TO TAKE IF YOU ONLY HAVE A WEEK.

HERE'S A ROUTE THAT LETS YOU SEE MORE OF THE WORLD NEXT DOOR.

AN OVERNIGHT SEACRUISE ABOARD THE M/S SCOTIA PRINCE.

AIR CANADA FLY/DRIVE.

SAVOUR *the* FLAVOURS

FRENCH WORDS YOU FORGOT COME BACK: BONJOUR (GOOD DAY!) AND AU REVOIR (SEE YOU!) AND EVERYWHERE, BON APPÉTIT! (ENOUGH SAID).

It happens all the time in Québec, the part of Canada that is unmistakably different with its felicitous mix of Old World ambiance, New World élan, and that vibrant joie de vivre.

Montréal in two words – cosmopolitan and historic. It's the second-largest French-speaking city in the world; last year it celebrated its 350th birthday. An island city, it's compact, perfect for serious shopping ... or simply strolling.

There are churches and oratories to visit, as well as 3,000 restaurants, great nightlife, and the International Jazz Festival. A quick flight from New York City, Montréal feels so ... French!

Less than an hour's drive south is the resort region of the Eastern Townships. Amid rolling hills are concerts and country inns, watersports and wines, the bustle of Sherbrooke and the calm of the abbey at Saint-Benoît-du-Lac.

About 90 minutes north are the Laurentian mountains. At charming communities like Saint-Jérome and Mont Tremblant, you can golf, swim, boat, hike, ride, and dine very well indeed.

Québec City, the historic walled capital, offers unforgettable sights ... the Château Frontenac, the Citadel, the cobblestone streets of Old Town, and the outdoor cafés along the Grande-Allée.

The North Shore of the St. Lawrence River leads to the deep fjords of the Saguenay River. The South Shore takes you to the Gaspé, with the famous 'pierced' rock at Percé, so dramatic at sunrise, so romantic at sunset!

Wherever you go in Québec, however long you linger, you'll hear the word Bienvenue! It's our way of saying 'Welcome!'

HERE'S A GREAT LITTLE TOUR TO TAKE IF YOU ONLY HAVE A WEEK.

HERE'S A ROUTE THAT LETS YOU SEE MORE OF THE WORLD NEXT DOOR.

AIR CANADA FLY/DRIVE PACKAGES AVAILABLE.

Québec City ... the Old World and the New. Lower Town and the Town Above. In the foreground, La Maison Chevalier, now a musée. In the background, the renowned Château Frontenac.

From the Mount Royal lookout, marvel at the skyline of Montréal. Then tour the city by bus, by car, by foot, or by horse-drawn calèche.

French cuisine and fine dining are matters of importance everywhere in Québec ... especially in the restaurants of the district called Old Montréal.

Heirloom or handiwork, old or new, the arts and crafts of Québec's master artisans tug at your heartstrings.

Visit the villages and country churches (the one here is at Mont-Tremblant in the Laurentians), then swim, fish, boat, hike, ride, golf, and ski!

Splendid in scarlet tunics, members of the Guards Band make martial music in July and August on Ottawa's Parliament Hill.

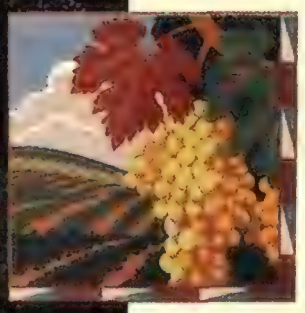
When you take an Island Ferry, you exchange the hustle and bustle of Toronto, Canada's largest city, for a relaxing walk, bike ride, or picnic on one of the bucolic Toronto Islands.

A gentle rainbow plays over mighty Niagara Falls, the world's most famous waterfall. Board the Maid of the Mist and feel its spray!

Don't let the Lion Mask frighten you. It may be fearsome looking, but a friendly Chinese Canadian put it on for a parade.

Golf is one of the innumerable pleasures of the Muskokas. Admiring the multicoloured leaves in the fall is another.

TRIP *your* IMAGINATION!



LET'S START WITH NIAGARA. THAT RAINBOW IS REAL, A REGULAR FEATURE, AND A COLOURFUL HARBINGER OF GREAT THINGS TO COME.

Just to the west, we jest! With the best of The Bard, at Stratford, or, nearby, the zest of the Shaw festival. For a change of pace, swing by the Guy Lombardo Centre in London. Munch at the Farmers' Market in Kitchener – especially come Oktoberfest. And savour the fruits of our orchards and vineyards. A nice little ice wine, perhaps? Prosit!

Spin up to Toronto, and take in the clean green big city scene, the SkyDome, gallerias galore and funky little stores, and your ever-looming CN Tower. Check in to a swell hotel, then stroll about and buzz with the night life, the lively arts and jumbo-delicious cosmopolitan flavours. This burg's cookin'.

Feel like a breather? Trip north to the 'Shining Waters' Ontario is famed for, and some of our best-loved summer playgrounds – Georgian Bay, the Muskokas, and Algonquin Park. Swim, sail, canoe, fish, hike, or just putter about. And relax, for our lakeside resorts will pamper you with the sleekest of creature comforts.

Farther afield, loom the rolling ranges of the Precambrian shield. Come September, take a day's train trip up the Agawa Canyon. And see the gorges glow.

Looping east, tour Canada's capital, Ottawa, with its gracious parks and public spaces, sedate canal cruises, museums and galleries, theatre, concerts, pomp and circumstance, and the neo-gothic grandeur of Parliament Hill. Step lively!

Or step back. Reel with the pyrotechnic spectacle of fusillades and cannonades at Old Fort Henry, in Kingston. Take a paddle-wheel cruise of the Thousand Islands. Delight in days gone by at Upper Canada Village, near Morrisburg. The nineteenth century churns on, with a genteel charm – and bread fresh-baked daily.

Whichever way you turn, golden moments await you, just over the rainbow.

HERE'S A GREAT LITTLE TOUR TO TAKE IF YOU ONLY HAVE A WEEK.

HERE'S A ROUTE THAT LETS YOU SEE MORE OF THE WORLD NEXT DOOR.

AIR CANADA FLY/DRIVE PACKAGES AVAILABLE.

A land of lakes and rivers awaits your pleasure. A plane will take you to a place of splendour where the fish greet the sun.

Paddle your own bright red canoe. Pause alongside Mount Wilson in Nahanni Country. It's an unforgettable feast of the senses.

Pat & Rosemarie Keough

Nelson Eddy may sing for you, but our Mountie smiles for your camera in Regina, Saskatchewan.

No need to fear this bear ... its spirit is caught in soapstone by the Inuit carver. Carvings are works of art and wonderful souvenirs of the North.

ARE YOU UP FOR R. & R.?

HERE'S 'LAND, LOTS OF LAND'. AND LAKES AND RIVERS, FISH AND BIRDS, FLOWERS AND ANIMALS ... EVEN THE AURORA!

Just the spot to do familiar things, like golf and shop; and elbow-room to do the unexpected, like flight see the wilderness.

Manitoba is mid-continent. Winnipeg, its capital, has so many attractions that the Michelin Guide awarded the city three-star status. Dine here on Winnipeg goldeye (a smoked fish), Western beef and Ukrainian perogies!

On foot, on horseback or on bicycle, follow the trails of Riding Mountain National Park. A train or plane takes you to Churchill, the Arctic sea-port with an 18th-century 'fur fort', polar bears, and 200 species of birds.

Saskatchewan is wheat-fields, parklands, and 93,000 freshwater lakes that teem with northern pike, walleye, and arctic grayling. The capital, Regina, celebrates the Mounties (see Chief Sitting Bull's tobacco pouch at the RCMP Museum) and hosts Buffalo Days, the exciting country and western fair.

Saskatoon, 'the city of bridges', offers river cruises and stages Shakespeare on the Saskatchewan. The world's largest tomahawk towers over Cut Knife.

To top it all off ... there's the vastness of the Northwest Territories. 'The Land of the Midnight Sun'. One million square miles. Four time zones. Only 54,000 people.

On summer days, expect to wear shorts. Yellowknife, the capital, hosts the Pacific Western Midnight Sun Golf Tournament. Camp beside a mountain; canoe a challenging river. Here's the real wilderness!

Manitoba. Saskatchewan. The Territories. Widen your horizons. 'Have a good day.' It lasts 24 hours!

HERE'S A GREAT LITTLE TOUR TO TAKE IF YOU ONLY HAVE A WEEK.

HERE'S A ROUTE THAT LETS YOU SEE MORE OF THE WORLD NEXT DOOR.

AIR CANADA FLY/DRIVE.

OUR BALLERINA CATCHES YOUR BREATH. WINNIPEG IS THE HOME OF THE CLASSICAL ROYAL WINNIPEG BALLET AND THE CONTEMPORARY MANITOBA THEATRE CENTRE.

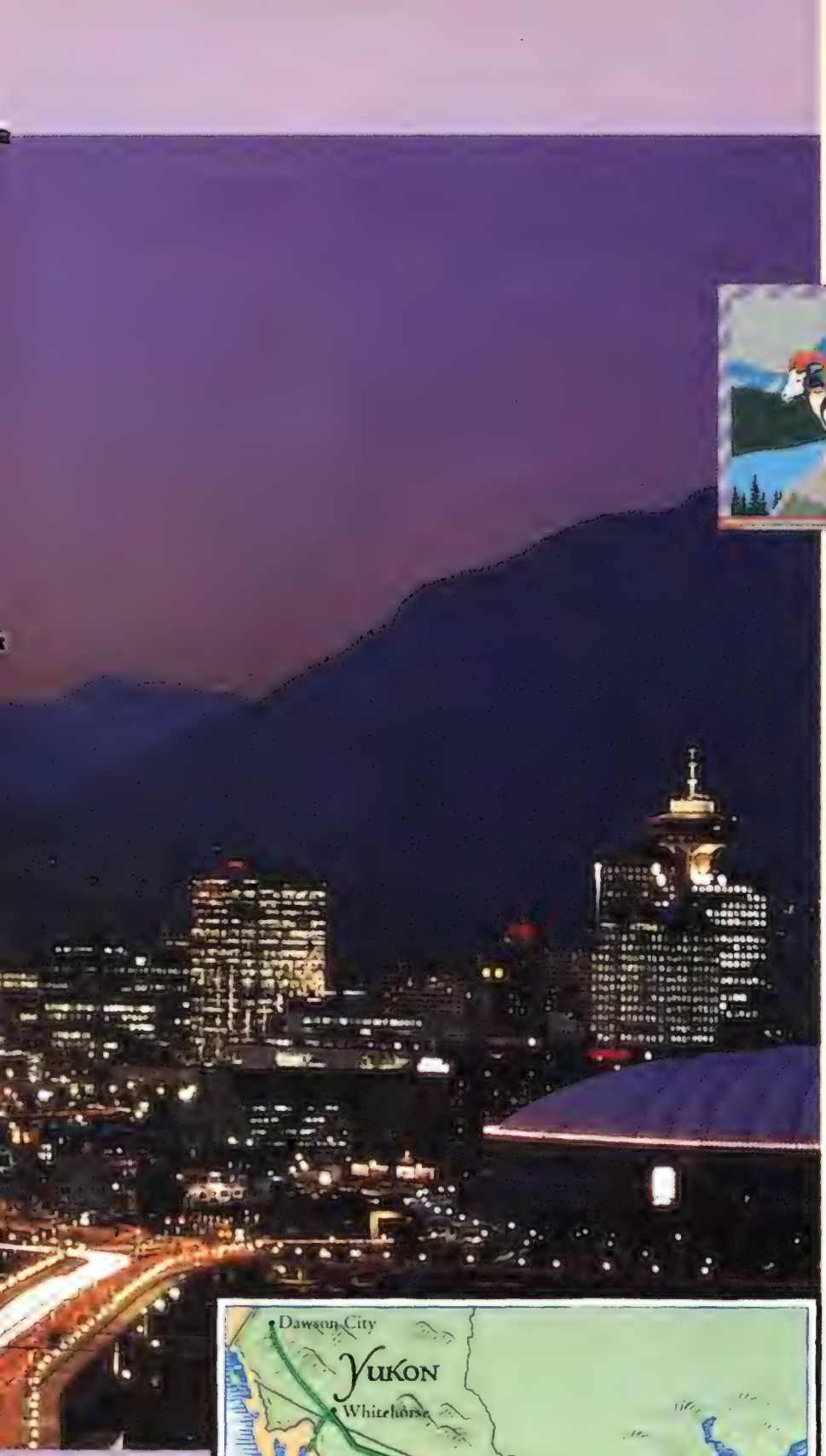
Meet Albertosaurus ... her nickname is Lillian. She stalks the halls of the Royal Tyrrell Museum, Drumheller, Alta.

Vancouver by night with light. Daytime attractions include the Ming Dynasty Garden and Science World (on the site of Expo '86).

The Haida work their miracles in wood. Raven, the trickster hero, is shown in this carved, painted ceremonial mask.

Like a fairy castle, Banff Springs hotel was built amid forest and mountain. It has a room with a view for you.

Flight see the Yukon, and opt for a 'copter tour of Canada's highest mountains and most awesome glaciers.



REACH
YOUR PEAK.

SHAKE HANDS WITH THE MYTH AND MAJESTY OF THE CANADIAN WEST.

Encounter spectacular coasts, lush rainforests, and awesome mountains. Enter a wild world of dinosaurs, totem-pole carvers, ranchers, prospectors, and friendly park wardens.

Begin big ... with the Rockies. Check into the romantic Banff Springs Hotel and ogle the views. For dinosaurs, all roads lead to the Royal Tyrrell Museum at Drumheller.

Edmonton, Alberta's capital, boasts the West Edmonton Mall, the world's largest shopping and indoor amusement centre – over 800 stores and an indoor beach. Calgary has skyscrapers, pioneer artifacts at the Glenbow Centre, and the rollicking excitement of the Calgary Stampede.

British Columbia is a place of splendour. The word even appears in the province's motto! Its capital, Victoria, recalls merry Old England; doubledecker buses ... floral gardens ... high tea at the Empress Hotel.

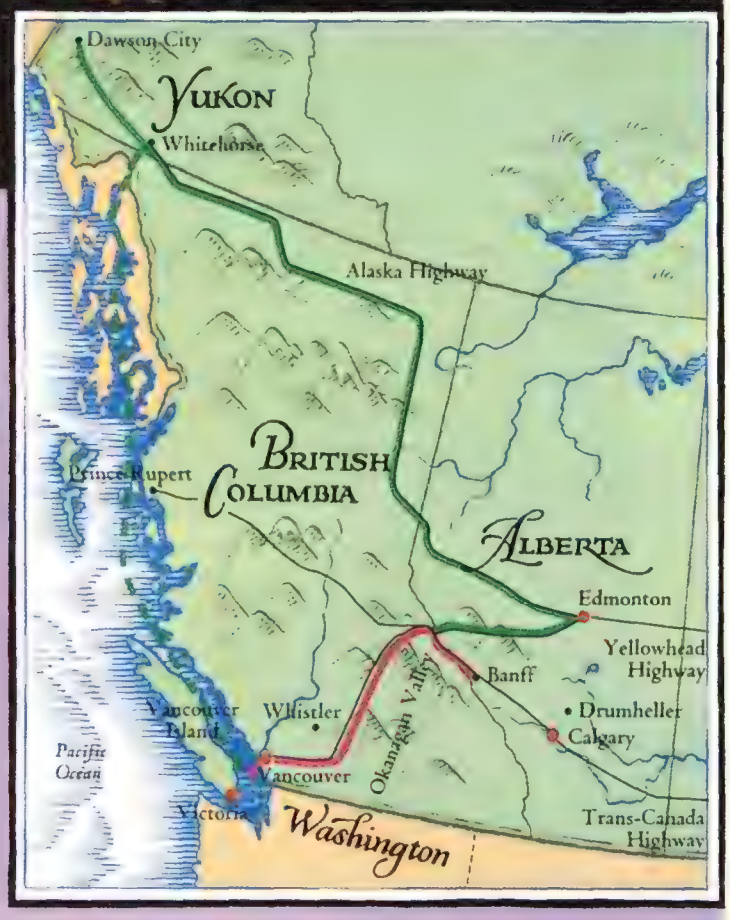
Nestled between ocean and mountain is Vancouver, Canada's third-largest city. It offers Gastown for shopping, Chinatown for food, Stanley Park for totem-poles, and the Super Skyride up Grouse Mountain for the panoramic view.

Cruise the coast; unwind on a Gulf Island. Sip the wines of the Okanagan Valley.

When you drive the famed Alaska Highway up to Alaska, you see a corner of the fabulous Yukon Territory. On the way is Whitehorse, the capital, with guided nature walks, river cruises, flight seeing, canyon tours – even a reindeer farm.

Farther north, discover Dawson City, the frontier Gold Rush capital. Visit the Gambling Casino, then the log cabins of writer Jack London and poet Robert W. Service. Hear an actor recite 'The Shooting of Dan McGrew' where the bard wrote it!

Come be a guest of the Canadian West.



HERE'S A GREAT LITTLE TOUR TO TAKE IF YOU ONLY HAVE A WEEK.

HERE'S A ROUTE THAT LETS YOU SEE MORE OF THE WORLD NEXT DOOR.

COASTAL CRUISE.

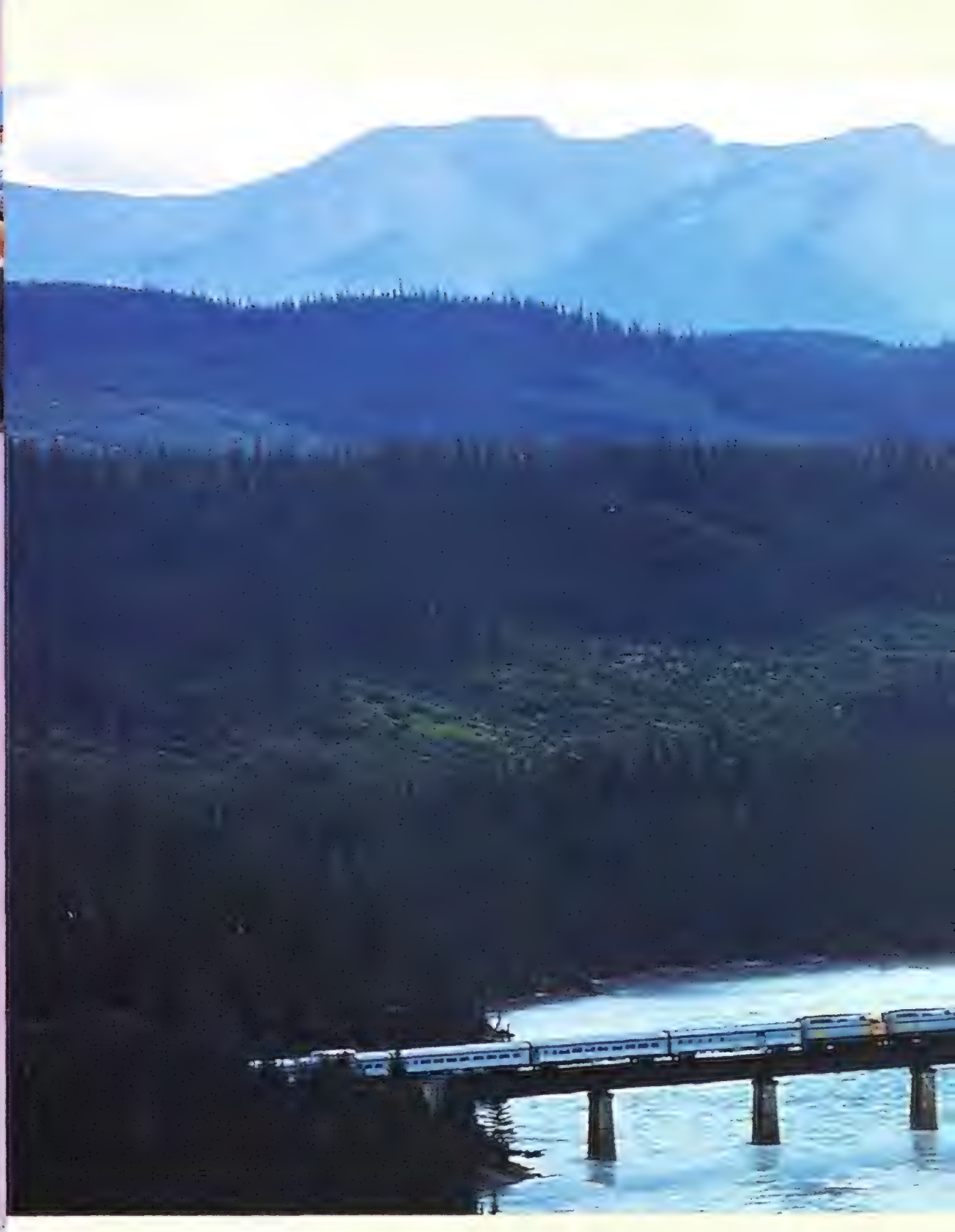
AIR CANADA FLY/DRIVE.

A REFORESTATION PROGRAM CALLED "PARTNERS IN GROWTH" HAS BEEN ESTABLISHED TO REPLENISH OUR VALUABLE TIMBER RESOURCES. FOR EACH TREE THAT IS USED IN THE PRINTING OF THIS PUBLICATION, ANOTHER TREE IS PLANTED

REFORESTATION PARTICIPANT
PARTNERS IN GROWTH

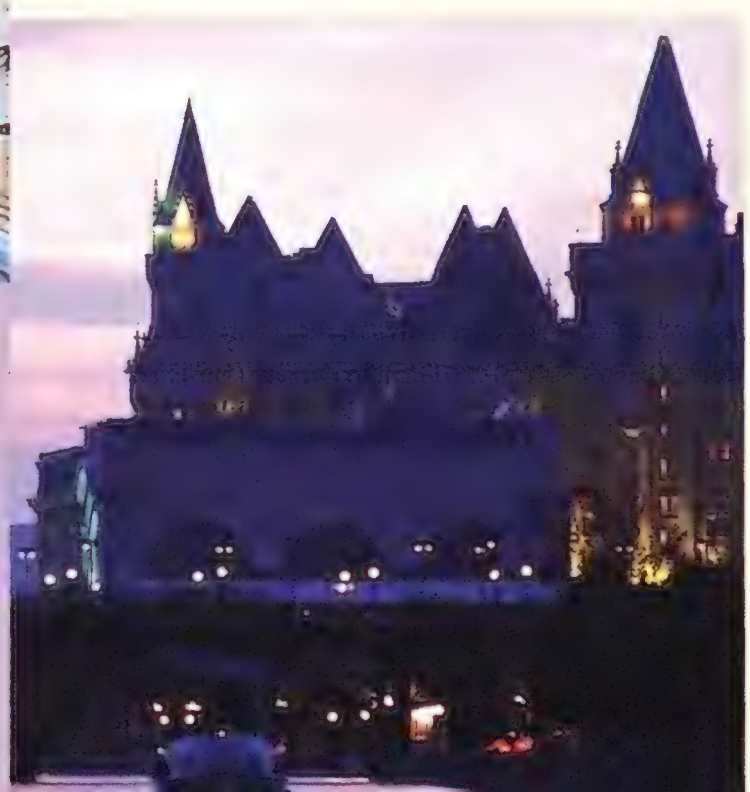
Rise above it all. The views are simply unbelievable from VIA Rail's Dome car.

How sweet it is! Where better to tempt your taste-buds than in an elegant chateau?

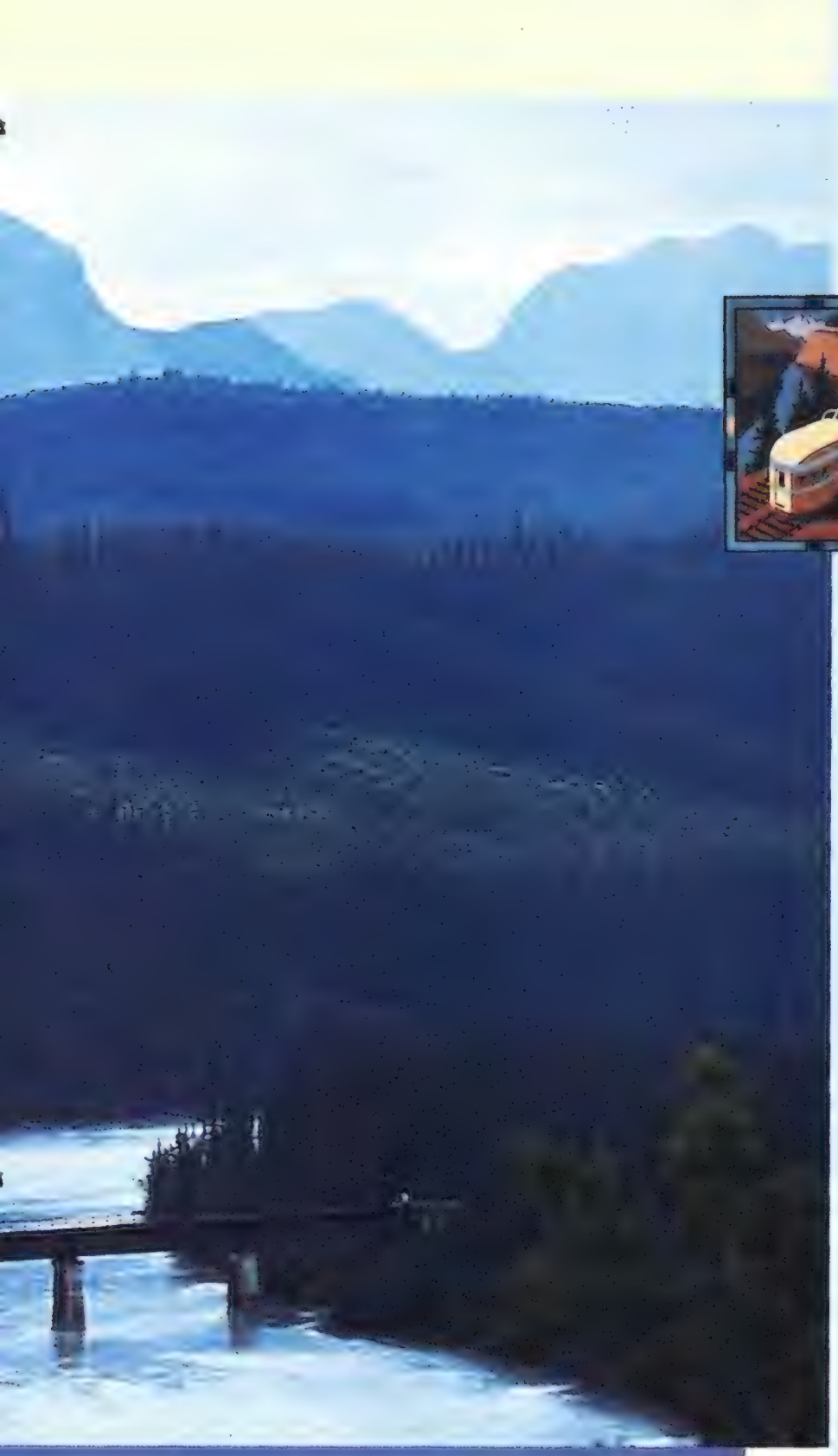


Terrific terrain! The Canadian™ traverses the Athabasca River bound for the Rocky Mountains.

Cool pool! Trompe-l'oeil artwork helps better your outlook in the health club of Toronto's Royal York Hotel.



A sight in itself, the Chateau Laurier overlooks the locks on Ottawa's Rideau canal.



SET SAIL FOR THE HIGH SEAS, AND TAKE THE SHORT-CUT TO THE WORLD NEXT DOOR, ABOARD THE M/S SCOTIA PRINCE. PACKAGES RANGE FROM A 23 HOUR MINI-CRUISE ($72 US) TO SEVEN DAY SEA/LAND EXCURSION INCLUDING ALL ACCOMMODATION, ($430 US) AND SOME GREAT FALL SPECIALS.

TRAINS *and* BOATS *and* GREAT HOTELS!

ALL ABOARD! Treat yourself to the trip of a lifetime, on one of the smoothest things going – VIA Rail's completely refurbished classic stainless steel train, The Canadian™.

Stroll about the Park Car, the Dome Car, the Dining Car, the Skyline Café. With some of Canada's grandest panoramas just out your window.

Go all the way from Toronto to Vancouver – or vice versa – in just three days and nights. Opt for Silver & Blue™ first class travel or comfortable coach class.

Ask your travel professional about VIA's train services across Canada. And ride the rails in the World Next Door!

Make Waves!

Book yourself – and your car as well – on an ocean-going overnight cruise from Portland, Maine to Yarmouth, Nova Scotia.

Arrive refreshed, eleven hours later, and having saved 858 miles of driving.

M/S Scotia Prince is a floating resort, a movable feast, with 315 overnight cabins, elegant dining, lively entertainment – and duty-free shopping!

Departures daily from May through October. Call 1-800-341-7540 for package details.

Treat yourself royally!

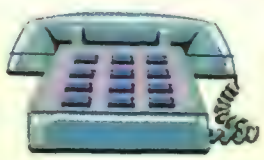
Why not stay at a landmark? Like Le Château Frontenac in Québec City, Château Laurier in Ottawa, Château Lake Louise in the Rockies, or the ever so gracious Empress Hotel, aptly enough, in Victoria, B.C.

Canadian Pacific Hotels and Resorts recently invested over $500 million to refurbish these magnificent properties. And add to the warmth of your welcome.

And for all you ball fans, from your suite in Canadian Pacific's ultra-modern SkyDome Hotel, see the Toronto Blue Jays at play!

For more on C.P. Hotels, call 1-800-441-1414.

For information on fly-drive packages courtesy Air Canada's Canada, please see the next page.

Of course, you'll need a world class flight *when you come to Canada and wouldn't it be nice if the hotel room was all arranged* *and you had the option of a car* *when you needed one. Then all you'd need would be an intriguing excursion* *or a little adventure* *in the great outdoors with perhaps a little rest and relaxation and seeing the sights to round your trip off.* *And if it was just a phone call*  *away...*

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With Air Canada you can put together a package that covers everything. Including great air fares and accommodations like Edmonton's Sandman Inn from just $29*. And car rental for three days from just $92**.

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Bristling with prehistoric menace, cornered snapper braces leathery legs and prepares to defend itself with powerful jaws. Relatively docile underwater, the turtle can be very intimidating out of its natural element.

By Bil Gilbert

The reptile that stakes its survival on snap decisions

It will win no awards for beauty or speed, but when it comes to ambushing unwary prey the snapping turtle is in a class by itself

During my boyhood, I lived in a three-house family compound located on the eastern shore of a long, shallow lake ten miles south of Kalamazoo, Michigan. Inland from the houses, my grandfather and father had built a public golf course on a sandy moraine that rose a few feet above the lake and a complex of associated ponds and marshes. Occasionally I did semi-useful work on the golf course, but mostly my friends and I just roamed about the watery countryside. It was, we believed, infested with snapping turtles as big as laundry tubs.

We did not take those monsters lightly. If one of them got you, it would either sever a hand or foot–in which case you bled to death–or drag and hold you underwater until you became soft turtle food. The only known means of getting free from one of the beasts was to cut off its head. Prudently we carried sheath knives in hopes that, if grabbed, we would be able to decapitate the attacker before it dismembered us.

I now have no recollection of how we came by those gruesome notions. There was only the most tenuous connection between observable reality and our snapping-turtle phobia.

Head up, tail out, a turtle with a mossy shell uses its webbed feet to swim in clear waters of Florida's Rainbow River. The snapper does all of its eating underwater–even food captured on land.

Certainly the reptiles were common. That the biggest ones we saw were only about the size of a dinner plate did not rule out the possibility that nearby there was one as big as a laundry tub. As I later discovered, this unit of measure was used throughout the Midwest by people who told snapper stories. As a matter of verified record, the largest known snapper weighed 85 pounds, but that was a captive that had been unnaturally well fed. In the wild, 50- to 60-pounders with 17- or 18-inch shells are occasionally caught. But few members of the species live long enough, 50 years or so, and eat well enough to attain such a size. All of which applies only to the common snapper (*Chelydra serpentina*), which is found throughout roughly the eastern two-thirds of the United States. The alligator snapper (*Macrochelys temminckii*), which is restricted mainly to several Central and Southern states, is a different matter. The accepted record for this species is 300 pounds; 150-pound animals with two-foot-long shells are encountered occasionally and 100-pounders more commonly.

People who are apt to meet up with common snappers very often carry a broomstick as well as a laundry tub. The former is offered to the turtle who, as the traditional story runs, "will bite clean through that broom handle like it was a stick of butter." Snappers do have hard pointed beaks, and the outer edges of their jaws are set with sharp bony plates. Used together with the animal's two front feet, these are good for tearing meat but not for severing broom handles.

It is beyond dispute, however, that snappers do snap, striking swiftly and menacingly at anything or anybody who annoys them. Furthermore, they have powerful jaws and tenacious grips. Twice I have seen snappers grab a duckling–and once a young muskrat–and drag it underwater. I have also had snappers hang onto the toe of my sneaker; they were dislodged without knife work, a few swift kicks being sufficient. Nevertheless these are pugnacious creatures, and getting crosswise with them can have painful consequences.

The worst snapper-attack story I have heard and believed was related by Jim Christiansen, a Drake University herpetologist. While conducting a field study in western Iowa, he trapped a 25-pound snapper and was carrying it in a burlap bag to a dry spot for measuring and marking. "I was thinking of something else," says Christiansen, "and was holding him carelessly with his head facing my leg. He struck, sheared through the bag and my blue jeans, and cut a two-inch, fairly deep gash in my leg with his beak."

On one occasion, Christiansen was bruised by a big snapper that was lying hidden underwater. The creature lashed out after Christiansen stepped on it, striking him smartly in the heel of his rubber boot with its head. "It feels something like being hit with a bat. The skull is solid, and they can extend their neck about two-thirds of the length of the shell. Much of the meat on a snapper is around the neck, and it is all muscle. In effect, snapping turtles are little battering rams."

Physically snappers are no more dangerous than an angry swan, badger, woodchuck or many other similarly-

Bil Gilbert, who presently does most of his turtle watching on a river not far from his home in Pennsylvania, profiled wolverines in March 1993.

sized animals. Out of the water they can be quite intimidating, but underwater, Christiansen emphasizes, they are usually very docile. In their range, however, few other members of the fauna have such exaggerated reputations. I think this is probably because they look so awful–that is, ugly and mean. The gnarled shell is usually covered with moss and slime. The tail is thick, fat and spiky. The eyes are cold and penetrating. The creatures lurch along like ill-made robots on splayed legs and wickedly clawed feet. Beyond their reflexive gaping and snapping, they hiss and smell bad.

If snappers project a decidedly prehistoric image, there is good reason. Some 250 million years ago, certain amphibians became covered with water-impervious scales and acquired the ability to lay eggs with relatively hard shells. In consequence they could operate, without drying out, on dry land. Those reptiles, now known as cotylosaurs, are thought to be the ancestors of all subsequent vertebrates. Very shortly as such events are measured, some of them developed tough external shells made up of developed bony plates. About 200 million years ago, they became essentially what they are today–turtles. As such, they waited and watched as the great dinosaurs came and went, as birds and mammals appeared, and as some of the latter improved themselves sufficiently to start fires, think about cotylosaurs and operate VCRs.

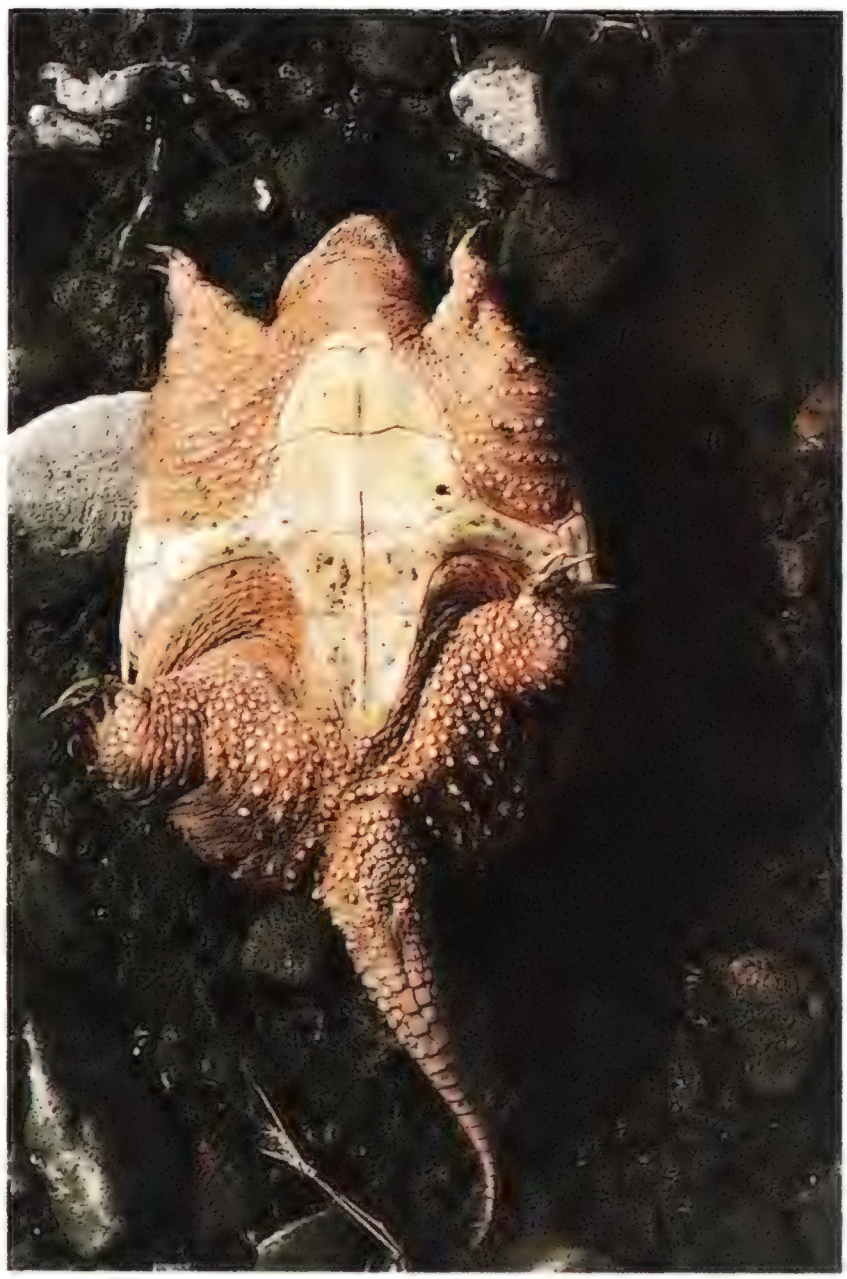
Among those of us presently here, turtles are the preeminent evolutionary conservatives. But while stubbornly retaining their basic chassis they have, somewhat like truck manufacturers, progressively adapted it to function effectively in a wide variety of niches. There are saltwater and freshwater turtles, woodland turtles, prairie and desert species.

Between the carapace and the plastron

The shells of snappers reflect the fact that, to the extent turtles can be, they are generalists who frequent deep and shallow waters and adjacent shorelines, but are also inclined to travel overland, sometimes for as much as a mile, between wettish places. The upper shell, the carapace, is relatively thin. It is made up of plates, with irregular ridges where they meet. It is tough enough to discourage casual terrestrial predators. The undershell, the plastron, has been reduced to a small, cross-shaped plate that leaves fleshy areas of the neck, legs and tail exposed. The effect of this diminished shell mass is to improve buoyancy in the water and agility, again by turtle standards, on land.

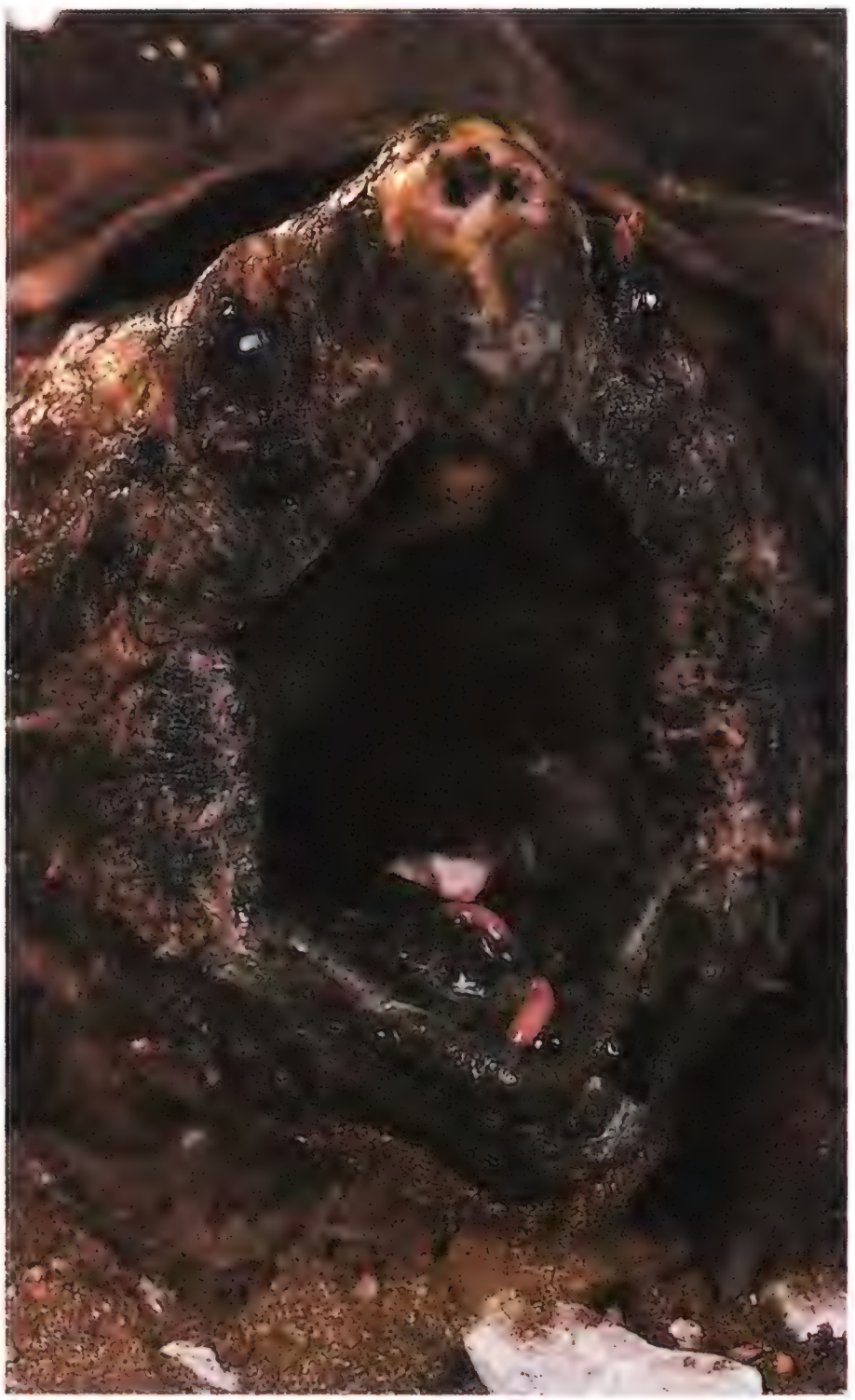
When it comes to eating, snappers like meat but will settle for just about anything. Analyses of stomach contents indicate that about half of their diet is made up of vegetable matter and carrion. In regard to the latter, snappers are among the most useful and effective of

A snapper uses its hooked beak to help secure a fish as its throat enlarges to accommodate size of meal.



Reduced size of shell on snapper's underside enables creature to gain weight and facilitates movement.

How the snapper gets its name



Alligator snapper wiggles pink "worm" at end of its tongue to attract curious fish, which it then gobbles up.

aquatic scavengers, being able with their powerful beaks, jaws and feet to pull apart virtually any carcass they encounter.

Like other turtles, snappers are equipped with olfactory bulbs. Though conclusive studies are lacking, it is assumed that they are to some extent scent hunters, particularly when foraging in murky waters. In this connection, there is another common snapper story that has become stylized through repetition. It goes more or less as follows: "There used to be this old boy, kind of a hermit, who lived on an island upstream from here and kept a big snapper he'd trained. When the authorities had reason to think there'd been a drowning but couldn't find the body, they'd get this old boy. He'd drilled a hole in the trailing edge of that turtle, and he'd rig him up with a stout leader and line, then reel him out into the water like a kite. If there was a corpse out there, that turtle would find it. My daddy watched them do it more than once."

So far as living prey is concerned, snappers feed principally on insects, crustaceans, amphibians and small trash fish. Claims of sportsmen that they are also frequent and formidable predators on waterfowl are probably exaggerated. In one investigation of snappers' food habits, it was found that less than 2 percent of their diet was made up of birds or mammals that were apparently alive when taken.

Occasionally snappers may directly pursue and capture their prey, but their opportunities and abilities for doing so are limited. Generally they employ ambush tactics, lying motionless in holes and aquatic thickets, waiting to grab unwary edible creatures that approach too closely. On this behavioral note it seems appropriate to return to the alligator snapper. This species is uniquely endowed as a lurking predator. At the end of an alligator snapper's tongue is a fleshy, wormlike growth. Settling into a deep hole, the creature opens its huge mouth and wiggles this appendage, which in these circumstances becomes engorged with blood and turns a pink, meaty color (left). Attracted by the seemingly tasty morsel, foolish fish swim within the jaws of the turtle, which instantly snap shut behind them.

The snapper ranges far and wide

Alligator snappers are occasionally found as far north as southern Illinois or Iowa, but normally they range only between western Florida and eastern Texas and are most common along the lower Mississippi and its tributaries. In contrast, the common snapper is found everywhere east of the High Plains and south of lower Canada, excepting a small area of northern Maine. Subspecies of *C. serpentina* have extended this range at least as far as Ecuador. The consensus among interested herpetologists in the United States is that currently

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A pair of snappers mate in water. When time comes to lay eggs, usually 20 to 40, the female will go ashore.

After digging a depression, female deposits a clutch in it and then distributes a layer of soil for protection.

snapper populations in the Midwest or wherever a significant number of farm ponds have been built are generally stable or better. In many rivers frequented by trappers, however, snapper populations are dwindling. Jim Christiansen, who has published the authoritative survey of reptiles in Iowa, believes that among the 14 species of turtles found in that state only the snapper and the painted turtle are increasing in number. The most obvious explanation for the snapper's current prosperity is that people have accidentally significantly improved the quantity and quality of suitable snapper habitat. "We've built hundreds of ponds and impoundments in the last 50 years," says Christiansen. "Even if there is no other water nearby, snappers usually show up a few years after a pond is filled."

Christiansen thinks there is a direct connection between the pioneering habits of snappers and their pugnacity. During the winter, dozens of snappers sometimes dig into a likely mudbank and hibernate together. Otherwise they are notably, often viciously, antisocial, there being veracious accounts of slashing, bloodletting encounters between adults. When releasing turtles that have been trapped for study, Christiansen has observed that often, rather than immediately fleeing, the creatures' first reaction is to lunge at and threaten one another. He speculates that, "basically because they are so ornery," dispersal among snappers is a continuing activity brought about by the desire or need of individuals to avoid their peers.

Another attribute of snappers especially suits them for modern living. Like turtles generally, they are less finicky than most aquatic species about the quality of water they live in. For example, they can endure, in fact exploit, oxygen-depleted waters in which agricultural and other organic pollutants have stimulated abnormal vegetative growth. The highest density of turtles Christiansen has ever seen in Iowa was in a pond filled mostly with painted turtles (*Chrysemys picta*) but at least a couple of snappers. The pond was located on the downside of a heavily used cow pasture. "It was the color and somewhat the consistency of pea soup. Not much else could live there, but that pond was wall-to-wall with turtles. All they had to do was lie there and suck in corn, manure, whatever washed down."

A fundamental reason for both the historic and contemporary success of snappers is that they are among the most reproductively vigorous of turtles. Mating occurs from April through November. When ready to lay, which she may do once a year in northern areas, sometimes twice a year in warm climates, a female leaves the water and scoops out a depression. In it she may deposit 90 or more eggs, though more typically there are 20 to 40 in each clutch. The eggs have thin, somewhat flexible shells. They are spherical and about an inch in diameter. After laying them, the female covers and smooths over the nest, to roughly camouflage or protect it, and then she leaves the site. With the sun providing incubating heat, hatchlings usually begin to emerge from the shells 55 to 90 days later.

Raccoons and a number of other mammals, birds and probably other turtles feed on snapper eggs and hatchlings, but with aberrant exceptions only humans prey on the adults. They have done so more or less forever because there are those who regard these beasts as delica-

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Iowan Fred Millard, who processes turtle meat and other wildlife "products," demonstrates a turtle puppet.

cies, despite their unappetizing appearance. One of those was my grandfather, who usually had a few snappers he had caught or bought and was fattening up in cages until they were ready to be fried, fricasseed or made into stews or soups.

As the odd-jobs boy, I was the principal turtle keeper and the assistant butcher. When we were engaged in this latter work, my grandfather invariably pointed out that each of the animals contained "five different kinds of meat." According to him, the pad of firm, pale flesh around the neck was almost identical to breast of chicken. Elsewhere on the carcass there was supposedly the equivalent of fish, lamb, pork and beef. There is no accounting for tastes, but it seemed to me then and still does, that turtle is turtle, often a bit stringy and strong but not bad.

Wherever there are snappers, you can usually find somebody who catches them in wire-funnel traps baited with any sort of carrion, and sells them to fanciers. Within the past decade, due largely to the decline of edible marine turtles and terrapins and to regulations protecting them, the commerce in snappers has greatly increased. It is not a business large or sophisticated enough to support trade associations or statisticians, but it is probably safe to say that hundreds of thousands of pounds of dressed turtle meat are now sold annually in this country. Approximately 60,000 of these turtles are processed each year by Fred Millard (above) who, at his farm near Birmingham, Iowa, operates the only federally inspected turtle slaughterhouse in the country.

As a boy growing up in rural Iowa, Millard was fascinated by turtles. He collected and kept a variety of species and of course ate snappers. He continued to deal in them after he became a professional fur trapper and buyer, selling dressed turtle meat to speciality markets and restaurants. Presently he sells 180,000 pounds of live turtles and processed meat a year. He charges $4.75 per pound for the meat. So far as the volume goes, his nearest competitor apparently is a man in Louisiana who processes 15,000 to 20,000 pounds a year and sells it locally. Turtle meat is an exceptionally popular commodity in Louisiana.

The mainstay of Millard's business is *C. serpentina.* No longer having time to catch snappers himself, he buys them from a network of suppliers who are located from Texas to New England. Many of the suppliers are also fur trappers who either bring in a load of turtles to Millard's place or collect and hold enough at home to make it worth his while to send a truck for them. As an addendum to big-as-a-laundry-tub claims: the largest of the thousands of turtles Millard has handled was a 62-pound animal brought to him from New York. Because of its great size he kept this snapper on display until it died last year of natural causes.

In addition to meat, Millard and his wife, Carolyn, have developed several other profitable sidelines involving turtle products. At a shop on the premises, they annually sell 3,000 or so steam-cleaned and polished turtle shells that they have made, or others can make, into clockwork housings, lamps, purses, coin banks, ashtrays and other curios. Many of their best customers are residents of Indian reservations who, the Millards guess, use the shells for ceremonial purposes or sell them to tourists. For this ornamental trade, Millard supplies all sizes and many species, from snappers on down to box, painted and map turtles. "We never knowingly take or accept any turtles that are endangered, rare or protected in any state," he says. "That's not just for business reasons. It's a principle with me. I like turtles."

For zoological freaks, $300 apiece

When Millard finds well-developed eggs in turtles that have been slaughtered, he puts them into sand-filled plastic bags that are not opened until hatching begins. Each year the Millards sell 6,000 to 7,000 of these hatchlings to pet dealers in Europe and Japan. Tiny alligator snappers are the most lucrative, bringing $12.50 each. The price rises steeply for oddities, which many species of turtles, for genetic reasons that are not well understood, are prone to produce. For example, last summer an albino snapper and a carrot-colored painted turtle hatched and immediately were set aside in special aquariums. Carolyn Millard is confident that they will fetch $300 each from private collectors of zoological freaks.

All of the Millards' customers for hatchlings are

abroad. It is illegal to sell native turtles of less than four inches in this country, but there are no restrictions against exporting them.

Trappers and processors are not much interested in turtles weighing under ten pounds. This is approximately the same weight at which the average creature reaches full reproductive vigor. In consequence, some interested herpetologists and public-game managers suspect that, if the commercial turtle market continues to grow, it may adversely affect the demographic composition of wild snapper populations and, perhaps eventually, their total numbers.

One who thinks this possibility should be investigated is Dan Nedrelo, a herpetologist who conducts studies for the Wisconsin Department of Natural Resources. Last summer, Nedrelo commenced what he hopes will be a several-year study of the status of the species in that state, along the Mississippi River.

Somewhat surprisingly, given his line of work, Fred Millard shares these concerns and is in a better position than any formal student to confirm them. Already, he says, trappers in some localities are finding fewer big snappers. This is why, as a private conservation project, he is now releasing annually 5,000 of his captive-reared female hatchlings into ponds, lakes and streams. Millard is convinced that the turtle business will continue to grow, and as its effects on wild populations become more obvious, there inevitably will be legislation to give the species greater protection. As a turtle fancier he favors more restrictive regulations, and as an entrepreneur he does not fear them. In fact, Millard is presently expanding his facilities so that eventually he will be able to deal only in turtles he has hatched and raised on his own farm. He speculates that, in time, he may concentrate on the hatchery operation to supply other commercial growers, who will raise snappers in somewhat the same way domestic catfish are raised now.

A reflexive, anthropomorphic reaction is that, if this comes to pass, it will be another bad example of Man's inclination to meddle with the natural order of things in order to gratify our own short-term interests. But the perspective of snappers is certainly much longer and no doubt different from ours. Judging from past records, it seems likely that creatures who are entitled to regard the brontosaur and mastodon as brief zoological fads will take turtle ranches in their stride, exploiting this curious niche until it disappears and then moving on to find another one.

Capped by a fragment of shell, a snapper hatchling emerges 60 days or so after the egg was laid. Chances of survival in the wild are not good. It takes several years for the protective carapace to become hard.

It's time for a change to the wines of Ernest and Julio Gallo.

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By Richard Wolkomir

Putting a new spin on pitching science to kids

In Chicago, physicist Leon Lederman is heading efforts to revolutionize the way our schools teach subjects from math to quantum mechanics

Numbers come alive as first-graders join teacher Carrie Parrott in counting-backward exercise at Lee School.

Leon Lederman, who won the Nobel Prize in Physics for bagging a particle called the muon neutrino, steps—gingerly—onto a turntable, holding a brick in each hand. He revolves.

Lederman is preparing to teach freshmen at the Illinois Institute of Technology about the conservation of angular momentum, and he is Exhibit A. But this game of spin-the-physicist may have a trickle-down effect: he means to use stunts like this to cast powerful spells on *little* kids, to get them crazy in love with math and science.

Spinning laureates? Little kids? Litmus paper? Hypotenuses?

This may be the ultimate mad-scientist trip. Or, as Lederman believes, it may be the saving of America.

He stretches out his arms and the turntable slows. He pulls the bricks to his chest and spins faster, like a figure skater. A tall genius with an Einsteinian mop of white hair, Lederman grins like a leprechaun as he revolves in front of this as-yet-empty lecture hall, embodying in his rotation the principles of angular momentum conservation. Meanwhile, he ponders a visitor's question. It is about his biggest experiment so far, tougher than cracking protons: the Teachers Academy for Mathematics and Science, which he started in 1990 in Chicago. Its aim is nothing less than to pump up science and math in Chicago's schools, triggering a social chain reaction that spreads to other cities and ultimately—who knows?—revitalizes American education.

"Maybe it won't work," he says.

He steps off the turntable and hands his bricks to his graduate teaching assistant David Fazzini. "On the other hand," he says, his intonations distinctly Bronxian, "if anyone's got a better idea . . ." And then he tells the assistant: "That made me dizzy—I better get one of those football players to stand on this thing."

It is an oddball equation: the Nobelist, the spinning turntable, this class for college freshmen, the grand plan for fixing America's schools. The constant is Leon Lederman, who thinks big—really big—about subjects he cares about. (And as if he doesn't have enough going on, he's also touring the country to talk about his new book on the evolution of physics. *The God Particle*, written with Dick Teresi, was published recently by Houghton Mifflin.)

Once up to his elbows in electrons, Lederman says he is now just a "research voyeur." He looks melancholy. But he brightens. "Most of my energy is going into education," he says. It began in 1988, when he was director of the Fermi National Accelerator Laboratory (Fermilab), near Chicago. The Secretary of Energy called to ask how Fermilab (and the nearby Argonne National Lab) might lend a hand to improve American children's dismal showing in science and math. Lederman said: "Have I got a deal for you!"

Taking a whirling dervish approach to physics laws, Lederman embodies principles of angular momentum.

Photographs by Richard Howard

Lee first-graders try out building blocks: assembled in a variety of forms, they will serve as teaching tools.

Under eye of teacher Barbara Bibbs, second-graders at Medgar Evers School sort pattern blocks by shapes.

The venue for the "deal" was Chicago. And the selling point, in Lederman's mind, was that a Secretary of Education had termed the city's public schools the worst in America. As Lederman cheerfully ticks it off, "We got gangs, we got dropouts, we got language problems, we got . . ."

In Chicago, 51.1 percent of the high school class of 1991 failed to graduate. And a staggering 79.2 percent of the city's 412,000 student population comes from low-income homes. If he could get Chicago students grooving on science and math, Lederman figured, he could do it anywhere. And he believed it was in urgent need of doing—studies comparing science and math students in the industrialized countries consistently put U.S. students near the bottom or dead last, bad news in a technology-driven world economy. Lederman blames the way science and math are taught, not the kids.

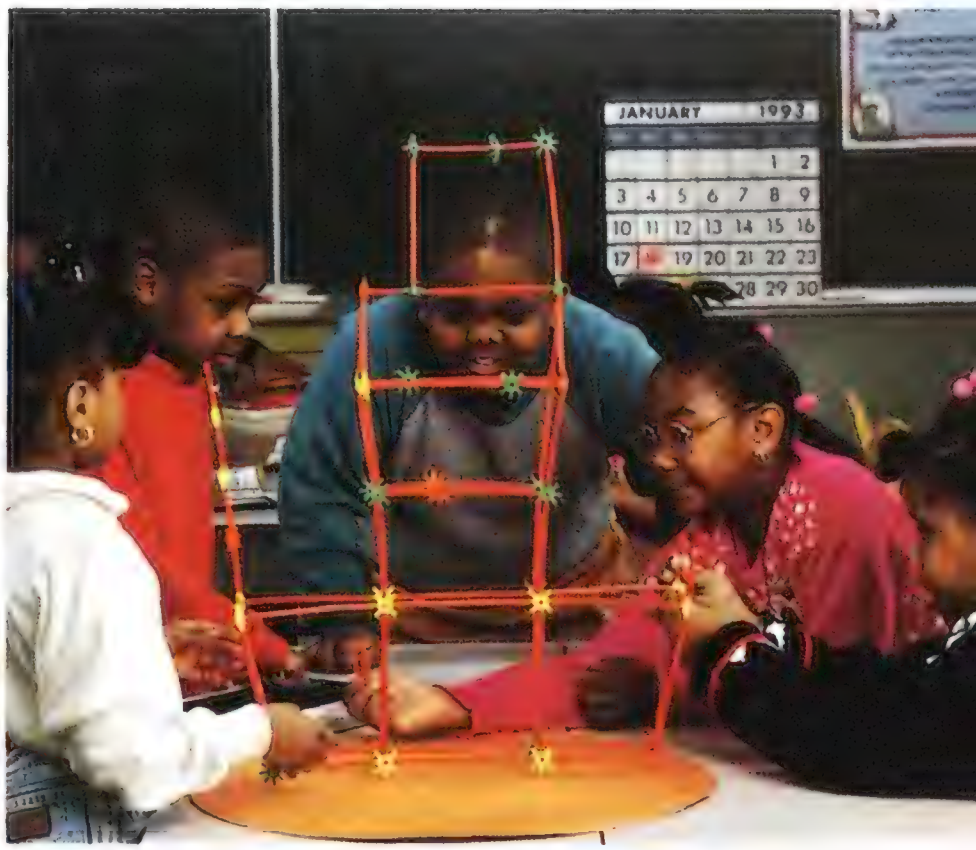
"Kids are *born* scientists—they drive you nuts with questions about how the world works," he says.

But somewhere between kindergarten and graduation, too many of them lose interest. Some of those turned-off youngsters become teachers themselves, after going through the nation's universities, where science is low on the academic totem pole. "Many of our colleges require just one year of science, so our best universities are turning out imbeciles," Lederman says. "It's a lucky high school physics class that has a teacher with a degree in physics," he adds. "And if the teacher hates the subject, kids know it."

To do something about that, Lederman pulled levers in Washington, D.C. and Illinois to get funding for the Teachers Academy for Mathematics and Science, which operates on the Illinois Institute for Technology campus. The idea is to turn teachers in grades kindergarten through 12 into born-again science and math enthusiasts. (For now, the program is offered only through the eighth grade.) The method is straightforward: provide classroom substitutes so the teachers themselves can take courses at the Academy, where they learn the best of the new teaching techniques. Many teachers can also come to the Academy for after-school, weekend and summer courses. Afterward, a cadre of Academy experts accompanies teachers back to their classrooms, reinforcing the new instruction methods.

After reviewing a mountain of educational research, the Academy has focused on "discovery" methods, in which students work out for themselves the principles of science and mathematics by doing their own experiments, whether it is measuring the lifetime of soap

Richard Wolkomir says he owes his writing career to math-and-science misadventures; after a taste of engineering school, he switched to journalism.



Barbara Bibbs' class uses geometric know-how to construct fanciful freestanding "solar collector."

Academy graduate Bibbs says blocks help kids become "geometric detectives," tracking squares, hexagons.

bubbles or figuring out how to count the bats in a cave.

In a way, it all goes back to a book Lederman's parents gave him 50-odd years ago, when he was a Bronx teenager: *The Evolution of Physics.* It was co-authored by Albert Einstein, but the real attraction was that it made science seem like a detective story. It gave young Leon the notion that science might be exciting.

His parents were immigrants from Odessa and Kiev, Russia. His father, who ran a Manhattan laundry, pushed his two sons to study. "He had been frustrated in his own urge to become educated, and so he tried to visit all his frustrations on his kids," says Lederman. His older brother dropped out of school but maintained a basement workshop and laboratory, where Leon was permitted to assist with chemistry experiments in exchange for doing his brother's household chores.

James Monroe High School nurtured Leon's budding interest in science. He fell in with a group of science-smitten youths and decided to become a chemist.

At City College of New York, however, he changed his mind. "The physics guys were more fun," he says. When he graduated, World War II was raging and he joined the Army, which sent him to MIT to learn Doppler radar, a new technology for zeroing in on targets, such as a fighter plane roaring over trees, by differentiating between what moved and what didn't. "But it turned out it wasn't quite invented yet, so I spent a year helping to invent it," Lederman says. "It was a cruel blow when I got caught speeding years later with a Doppler radar gun, and the judge didn't care when I explained that I'd helped create the thing."

Lederman earned a PhD in physics at Columbia University and taught there for 28 years. From 1979 to 1989 he was director of Fermilab, where he oversaw creation of the Tevatron, the world's most powerful particle accelerator. He claims that had something to do with the creation of the Teachers Academy: "It's the megalomania of the particle physicist—once you've built an accelerator, and it works, you think you can fix an inner-city school system."

The Academy (where he is now interim director) was not his first venture into pre-college education. At Fermilab, he had invited students from neighboring high schools to the laboratory for lectures by scientists. When he discovered that many of the students' teachers actually knew little about science, he began lectures for them, too. Later he godfathered the Illinois Mathematics and Science Academy, a three-year public residential high school for the state's exceptional students. The first graduating class, in 1989, was the nation's top scorer on the American College Test, a university admissions exam.

Lederman's zest for teaching is not just theoretical.

Selling science, Lederman-style

At the Johnson School, teacher Janice Ransom uses M&M's as aids in an introduction to bar graphs.

In 1989, when he left Fermilab for the University of Chicago, he stipulated that he teach freshmen, especially humanities students turned off by science. And when Lederman recently began teaching at the Illinois Institute of Technology—"I thought this place is positioned to become the MIT of the Midwest, or maybe the Caltech of the Mideast," he observes owlishly—he again demanded freshmen, whom he likes to teach by spinning on turntables, blowing a police whistle, and decorating diagrams of colliding particles with cartoon balloons that proclaim "Wham!" and "Kapow!"

Lederman has been accused by colleagues of stand-up-comic ambitions, to which he says, "Teaching *is* performing." Once he hung a bowling ball from the ceiling by a wire. Then he clambered up a ladder, lifted the ball to his nose and let it go. As the class watched, frozen, the ball swung far out on its wire and then rushed back toward the grinning professor's face, stopping a micron from his nose.

"Conservation of energy means the ball can't possibly swing back any higher than its point of release," says David Fazzini. "But his standing there certainly demonstrated great faith in the laws of physics."

He has an ulterior motive, which is saving science. Lederman believes U.S. science is in a "malaise." "Too many brilliant scientists are spending half their time looking for money," he maintains. He says research universities are stressed, and U.S. industry is cutting back on basic research. "Meanwhile, Western Europe is having an exuberant time, and Japan is turning to basic research." He cites a joke in which the Japanese explain their new interest in basic research by complaining, "We stole all your stuff, but now you're not supplying *new* stuff."

Lederman hopes his new book will get more people interested in science. He has lobbied network TV executives to give science a chance—"How about a series called *L.A. Science?*" Another of his favorite ideas is a science news show, coanchored by Bill Cosby and former astronaut Sally Ride. For some reason, the networks have resisted. Meanwhile, Lederman has been teaching his freshmen: "I especially like liberal arts students, because they'll make up the future budgets."

Triggering look-alike programs nationwide

But now his best bet is turning Chicago's inner-city schools into engines of science and math that trigger efforts nationwide and turn out a new generation of gung-ho scientists, as well as voters and politicians who understand the value of a well-spent science dollar. Given Chicago realities, it is one lollapalooza of a job.

From their upper-floor windows, the Academy's 70 staff members look out on Chicago's South Side. They see elevated trains rumbling past grim phalanxes of

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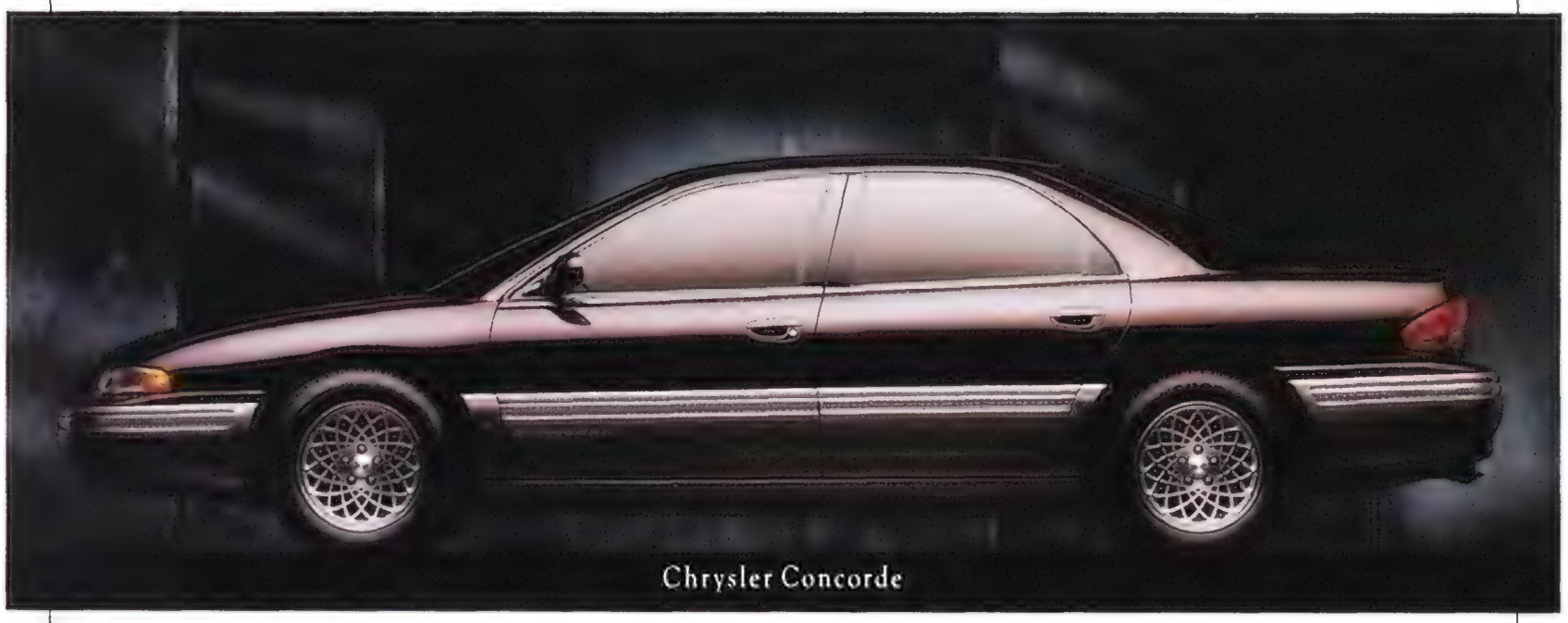

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Bibbs helps two second-graders use base-ten blocks to build aggregates of ones, tens and hundreds.

On follow-up visit to the Albany Park Academy, Steve Livingston oversees session on calculating pi.

high-rise public housing projects. Men aimlessly roam the streets. A crowd mills in front of a blasted-looking brick building backed up to the El, its orange-painted facade bearing a sign: "State View Food And Liquors (We Accept WIC Coupons)." The Academy's building has a guard who checks passes.

In large swaths of Chicago, the streets are mean. Schools are sealed like fortresses. As one teacher noted during an Academy workshop, "Worrying about the environment is not a high priority for these kids—they're worrying about getting home without getting shot." Yet, the schools are valued more than outsiders might think. The principal of Chicago's James Weldon Johnson School, Mattie Tyson, says, "The parents are very much involved—we're about all they have."

Her school is one of the city's poorest. "One hundred percent of our students qualify for free lunches," she goes on, adding that feuding gang members recently brawled in a dilapidated park across the street. Inside the school, however, the situation is brighter since teachers have completed the Academy's training. "Now they're trying all sorts of crazy things," Tyson notes enthusiastically, explaining that teachers have begun running math and science workshops for parents, too. "I wanted to see hands-on stuff and, God!, are we seeing *that*!"

First-graders, for instance, have created bar graphs showing the numbers of left- and right-handers in the class. The 6-year-olds also conducted a scientific experiment to see if all apples have the same number of seeds. They worked in teams because that makes performing well part of the group zeitgeist.

In addition, experiments with handedness and apples are cheap. That is vital in schools where dedicated teachers often dip into their own wallets to buy class supplies. Johnson School students do not need high-powered microscopes to compute how many marshmallows fit into a jar or to gather data on the numbers of red, yellow or green M&M candies in a package.

Bigger kids try bigger things. But their equipment can be just as cheap. One afternoon, eighth-graders hunt for pi—the ratio of a circle's circumference to its diameter—at Chicago's Albany Park Multicultural Academy, where 39 percent of the students are Hispanic, 27 percent Asian, 12 percent African-American, and where languages range from Urdu, Hindi and Arabic to Vietnamese. Steve Livingston, an Academy "model teacher," hands out big and little tin cans, rulers and strips of cash register tape. "These rulers don't

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Traveling Academy executives Alvin Grant and Alice Griffin set off to look in on participating schools.

bend, so how are we going to figure how many centimeters-around each of these cans is?" Livingston asks. Chris Thompson and Michael Brown, wearing flappy sweatshirts, puzzle over their cans. Michael raises his hand: "Put a string around it and measure that."

Livingston suggests using the cash register tape instead of a string because it's easier to mark. This room is chockablock with junior high hormones, which makes the students' fierce concentration on their tin cans seem uncanny. Chris and Michael painstakingly draw pictures in their notebooks, showing their own hands wrapping tape around a can and measuring it, visualizing the experiment's methodology. Then they record each can's diameter and circumference in centimeters. Next they graph the data. Working with the numbers, they make a discovery: small can or big can, the circumference divided by the diameter always equals something close to 3.14, or pi.

"It's a folk belief that if you're poor, you're stupid," says Albany Park's principal, Mary Lee Lasher. She is passionate about the Academy's impact. As she puts it, "When you see kids rolling toy cars down the halls out here to measure velocities or graphing their own attendance every day, or graphing NBA wins and losses versus the weather, *that's* a different style!"

Leon Lederman's grand experiment may yet work. "Our Illinois Goals Assessment Program test scores went *way up*, especially in problem solving," says Mary Lee Lasher. According to the Academy's former director, Jon Thompson, the aim is the withering away of old-time droning lectures, deadly book lessons and rote memorization. Calculators are OK. "I don't remember how to extract a square root by hand, so why should I expect my students to?" asks Thompson. Academy methods, he says, let kids learn with their hands: "You want to learn about slope, so which is better—memorizing formulae or experimenting with an adjustable ramp and little cars?"

Even math can come alive. For instance, after 20 years of teaching, Rosetta Paige recently completed the Academy's mathematics program. Not long ago, Academy executives Alvin Grant and Alice Griffin, both retired Chicago public school administrators, visited Paige's class at the Richard Henry Lee School as she asked her 21 first-graders, "Can you be super-listeners?"

"Yes!" in unison.

"Do you know any super-listeners?"

"My brother." "Mom." "My dad." "Me."

It is decided that the best super-listener is Superman. Paige produces a "super-listening can," which looks amazingly like a large tin can. "What does it have drawn on it?" she asks. "An ear!" "Do you have to keep your eyes open to listen?" "Yes!"

"What?" asks Paige. "Close your eyes."

She drops pennies into the can, each falling with a loud clink. Hands over their eyes, the children count five clinks.

"Now I *know* you're super-listeners," Paige tells them. "We're ready to play a game of pretend."

The game consists of pretending to put a certain number of pennies into the can, such as four. Then Paige clinks real pennies into the can, and the class counts on—five, six, seven, eight, nine!

"How many pennies in the can?"

"Nine!"

"How many real pennies did I drop in?"

"Five!"

"When I put in more pennies, what am I doing?"

"Adding!"

Next, the class tallies the number of telephones in each student's home. It ranges from zero for a newly immigrated Polish girl, who communicates via a bilingual classmate, to two students with five telephones at home. Each child chalks a tally mark in the appropriate column on a blackboard table. The data tells all: most homes have just one telephone.

Bursting out all over: math

In the back of the room, Principal Marjorie Joy whispers to the Academy visitors: "I come in here when I'm depressed—it's the best psychiatrist in the world." And she adds that math is bursting out all over. "You see kids doing math for fun in the hall." Kids bring in numbers from license plates, price tags, street signs, football jerseys . . . "They're discovering the importance of numbers, and they think it's great," says Joy.

Now Paige is clapping in time as student teams count in unison, each team picking up where the previous team left off, counting to 100 and beyond. Next comes

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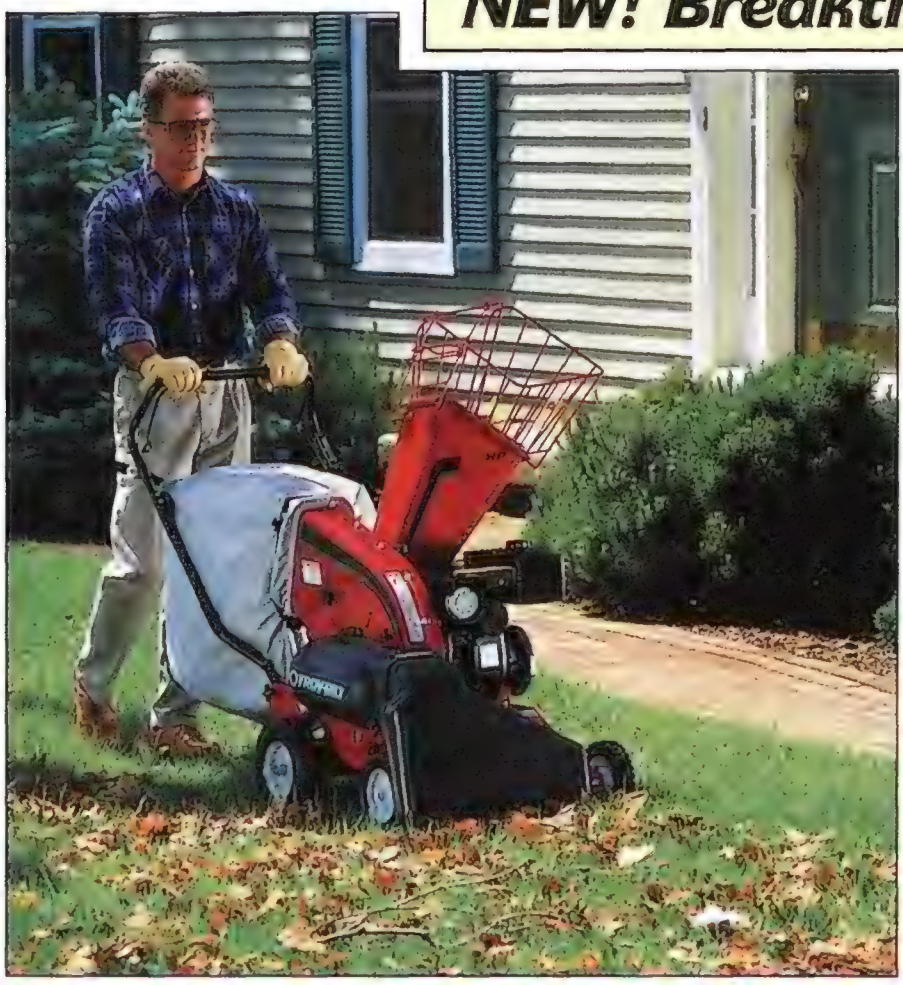

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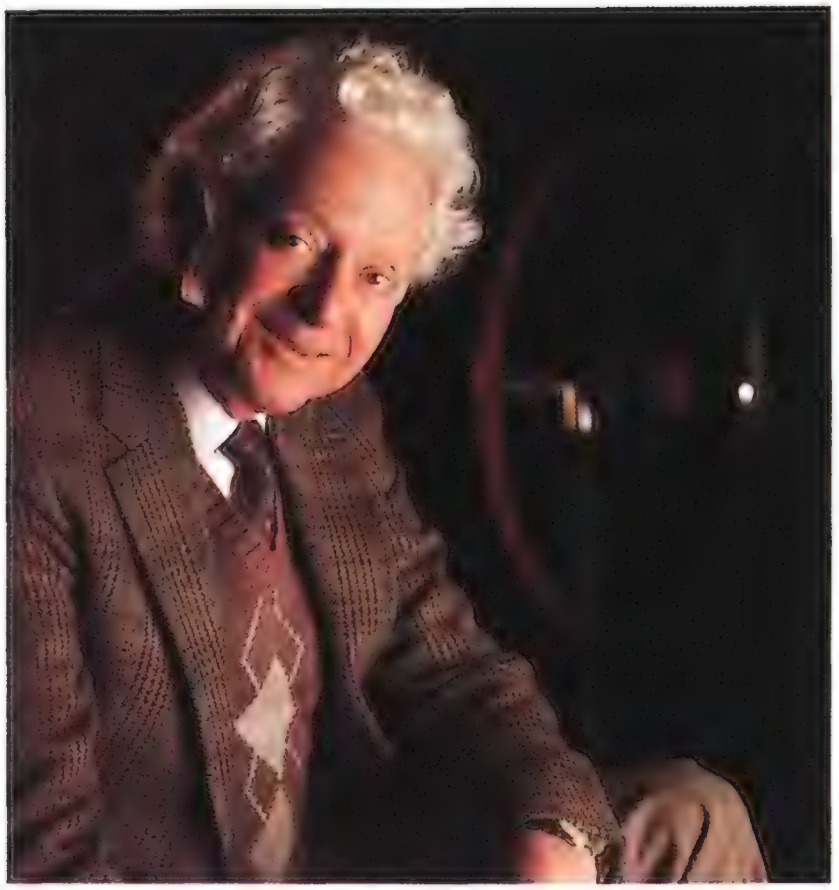


Lederman asserts that relatively modest investment in science education will yield big dividends in future.

counting backward. Paige asks, why would anyone do that? "Rocket blasting off," is one answer. "Football game with just seconds left." "Thermometer is dropping." "New Year's." The backward-counting teams hit zero. Class ends with a cheer from the counters. And—as if this were Broadway, a bravura performance—the visitors break into spontaneous applause for Rosetta Paige.

Schools can sign up for Academy training only if 70 percent of the teachers and staff votes yes. Full-time Academy classes last up to 16 days. Afterward, model teachers from the Academy stationed at the school help with the transition. And the school joins a growing school-to-school computer network, with links to Chicago's museums, universities and labs. A problem has been the accommodating of all the schools that want to get their students tallying how many bones they have in their bodies and computing their arm spans versus their heights.

The Academy's budget is currently about $6 million a year, mostly from the Department of Energy and the National Science Foundation. In its start-up period, more than 700 teachers from 30 schools completed the full-time classes, and another 6,000 took special workshops. But Chicago's public school system is the country's third-largest, with some 26,000 teachers and administrators. More than 20,000 in 551 schools teach at least some math or science in grades kindergarten through 12, which means the Academy has far to go. Meanwhile, it hopes to work with teachers colleges, too. Fixing Chicago, and then the whole country, means big bucks. But Leon Lederman—whose annual Fermilab budget was $180 million—is used to thinking big.

"We figure the Academy needs $30 million a year, and $500 million a year when we go national," he says. "We don't consider that serious money."

He argues that education is the best way to stop the inner-city poverty cycle. Academy officials cite studies showing that upgrading students' science and math skills improves their abilities in other areas too, such as reading. Meanwhile, Lederman emphasizes science's importance to the nation's economic health. He has calculated that quantum mechanics alone, as manifested in technologies like computer chips, underlies a significant fraction of the gross domestic product.

As the Academy's top booster, Lederman recently invited Chicago CEOs and foundation executives to the Academy. In exchange for a sandwich, they listened as Lederman and Chicago school officials explained why the visitors should give the Academy dollars and donate their staff scientists to serve as teacher mentors. "We know that when it does work, it *really* works—the schools come alive," Lederman said.

To prove it, he introduced an Academy graduate, Barbara Bibbs, who teaches second grade at Chicago's Medgar Evers School. She spilled onto a table the wooden rods and cubes and squares her students use to get a grip, literally, on math concepts. And then she took over the room like a cheery tornado.

"After we began teaching this new way, I saw a change in my students—because they *wanted* to do more math," she said, demonstrating how rubber bands stretched around the pegs on a pegboard can let kids create triangles, circles and the rest of plane geometry.

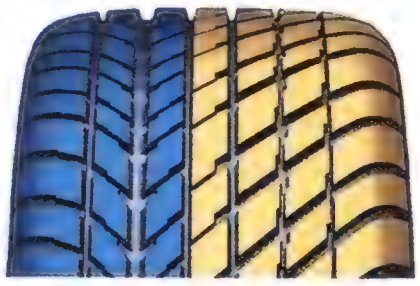
"Now I'm hearing one second-grader telling another, 'Loan me a trapezoid!' " she pointed out. "If that isn't the cutest thing in the world, and they'll look at your earrings or the patterns in your clothing and say, 'Hey, an ellipse!' We've found that math now crosses the curriculum to music, art and everything else, because they realize they exist in a *world* of mathematics.

"You see these kids in their high-top sneakers and rapper outfits giving each other high fives over getting a math problem right, and you *know* they are *really* getting into it!" Bibbs said. While she spoke, Leon Lederman was leaning on the table behind her, listening, with his white hair sticking up like some sort of complicated antenna. However, the Nobelist's hands wandered, as if of their own volition, to the red and blue and yellow wooden blocks she had spread on the table.

Afterward, the physicist and the second-grade teacher hugged. And the teacher said, "I saw you, Leon Lederman—playing with that hexagon!"

Visiting Academy instructor Marshall Brown discusses math projects with students outside McCorkle School.

WILL BITE WH



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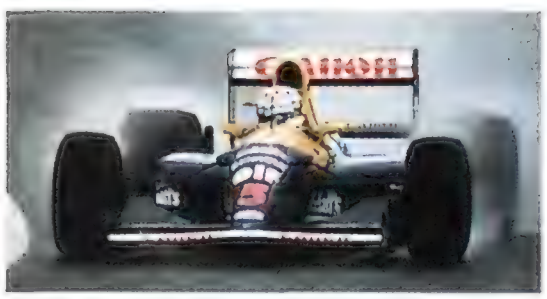

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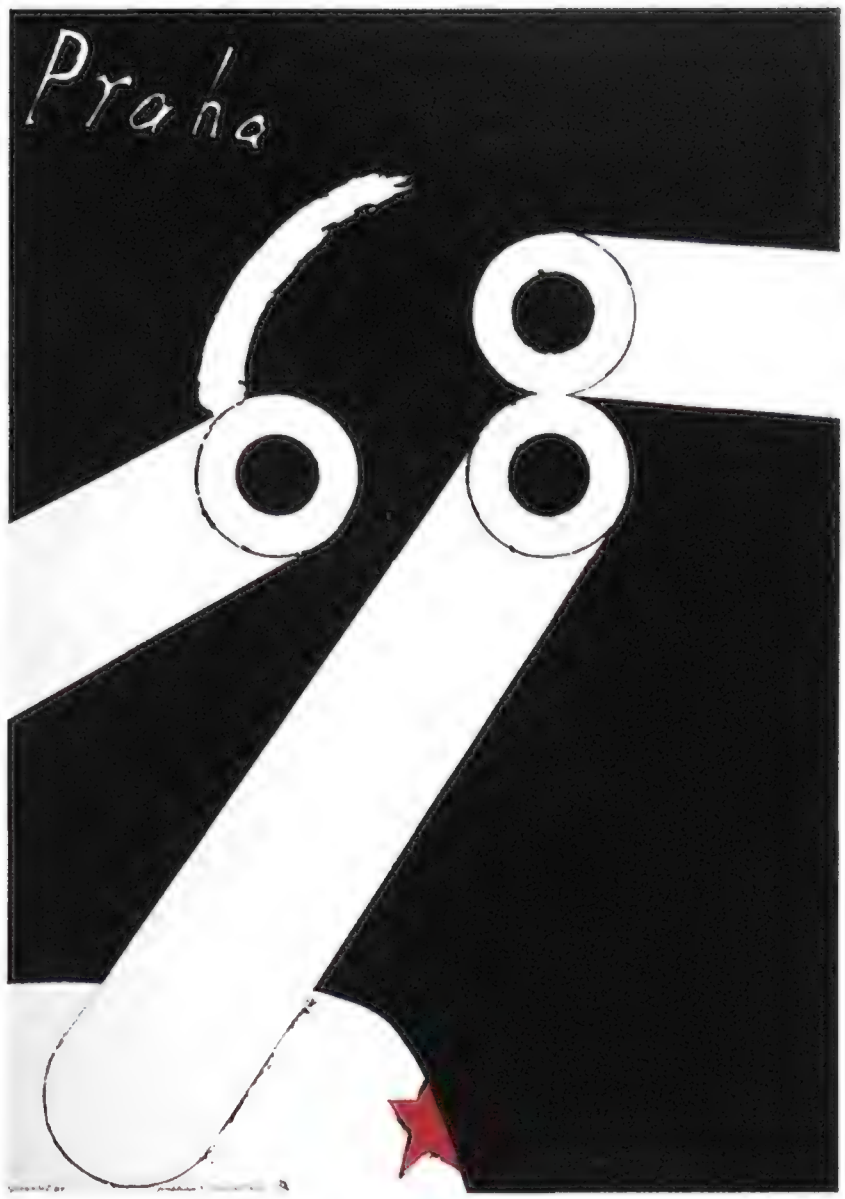
Taking art into the streets of Eastern and Central Europe

When revolutions swept through this part of the world in 1988-90, posters became an unexpectedly strong weapon for the people



Prague 68, Krzysztof Ducki (Hungary, 1989). In Czechoslovakia, this poster recalled earlier "Prague Spring," which was cut short by Warsaw Pact tanks.

"Art as Activist: Revolutionary Posters from Central and Eastern Europe" is an exhibition drawn primarily from the collections of the Moravian Gallery in Brno, Czech Republic. Curated by Marta Sylvestrova at the Moravian Gallery, and Dana Bartelt, a North Carolina graphic designer, and organized by the Smithsonian Institution Traveling Exhibition Service, the show is now on tour. It can be seen at the Columbia Museum of Art in Columbia, South Carolina, until May 23; its next stop is the Federal Reserve Bank in Kansas City, Missouri, June 4 to July 16. In 1988-90, the years when most of these posters were made, Sylvestrova journeyed throughout Central and Eastern Europe collecting them. The following passage is adapted from her essay, "The Art of the Street," in the exhibition catalog.

In liberal democracies such as America, poster art is overshadowed by television, broadcasting, film and video. However, under the totalitarian regimes of Central and Eastern Europe, all mass communications were under strict control of the governments. But the censoring authorities could not stop the production of hand-drawn and privately printed posters that appeared on the streets, walls and windows of the cities and towns during antitotalitarian revolts.

Posters were everywhere—on shop windows, taped on walls, dangling from city monuments. People pinned them on their own bodies and carried them in demonstrations. During the "Velvet Revolution," Prague students covered a train with posters, bringing news to remote villages and towns concerning the brutal police action against the demonstrators.

Power, Alexander Chantsev (Russia, 1990). Chantsev memorializes the millions terrorized and murdered during Communist rule with a crimson KKK-type hood.

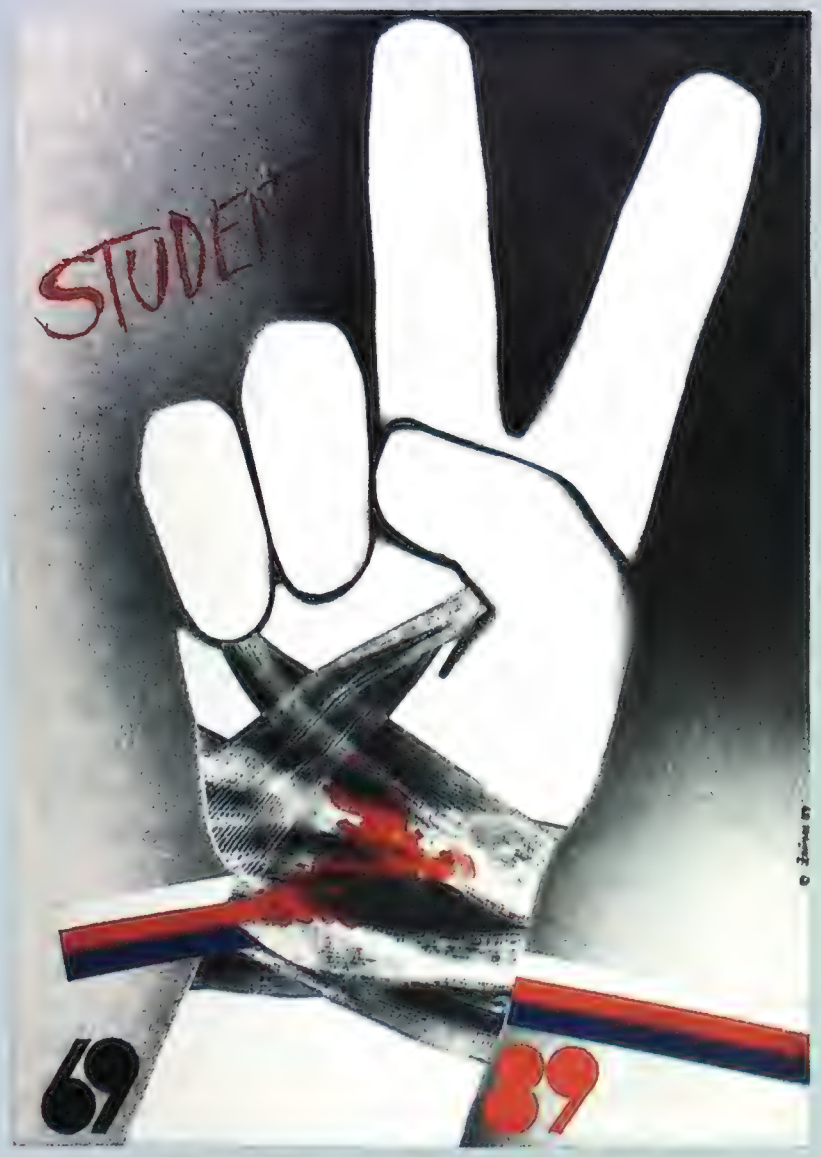
The major event of 1989 occurred on November 9, when crowds began to tear down the Berlin Wall. The exuberant posters from the period of the removal of the Wall also conveyed a nervousness about the outcome; East German posters referred to the problem of the country's being swallowed up by its strong and wealthy neighbor, West Germany, during reunification (p. 121).

As the revolutionary movements traveled from one country to the next, sweeping out the Communist regimes, the poster became a kind of roving ambassador, supporting them all. Artists took their trade from city to city, making sure that posters would document critical events as they unfolded.

"It is common knowledge that revolutions are not made by professional politicians, especially not in these parts," wrote Hungarian poster designer Istvan Orosz. "Politicians tend to return when things are stabilized enough to tell who is winning." In the meantime, he said, the writers, poets and artists were likely to be at the forefront. And the poster was their most potent weapon.

The Joke, Vitali Levchenko (Russia, 1987). After a West German flew 800 miles across Soviet airspace and landed in Moscow's Red Square, several Soviet officers lost their jobs.

Budapest 1956, Prague 1968, Vilnius 1991, Konstantin Geraymovich (Russia, 1991). This poster was made by a Russian artist in support of Lithuanian independence.



Students, Dusan Zdimal (Czechoslovakia, 1989). Unarmed students were injured in clashes with armed police during 1968-69 protests and in 1989 "Velvet Revolution."

At the right: *Perestroika?*, Assen Stareyshinski (Bulgaria, 1988). The poster refers to Bulgarian leaders who faced backward even as *perestroika* developed.

We Are the People, Matthias Gübig (East Germany, 1989). After the reunification of Germany, the "sheep" (East Germans) feel consumed by "wolves" (West Germans).

Gloria in Excelsis—Civic Forum!, Pavel Benes (Czechoslovakia, 1989). In 1989, Czech Christians openly celebrated Christmas for the first time in four decades.

Welcome, Pierre Cardin, Igor Vachitov (Russia, 1990). The artist is inviting the famous French clothing designer to create a fashion line for Soviet working women.

Untitled, Anonymous (Czechoslovakia, 1989). In one of the many unsigned and hastily executed posters that appeared, a modern Pied Piper leads "red rats" out of town.

As You Work, So Shall You Be Rewarded, Yuris Dimiters (Latvia, 1987). The artist is suggesting that the Soviet system awards meaningless medals for worthless work.

Happy Birthday, Komsomol!, Alexander Faldin and Rashit Akmanov (Russia, 1988). Communist youth groups, who wore red kerchiefs, are equated with the old leaders.

Temesvar-Timisoara, Istvan Orosz (Hungary, 1990). This artist pays tribute to victims who died during the 1989 demonstrations in Romanian town of Timisoara.

Democracy—Freedom—Peace, Boris Bucan (Yugoslavia, 1990). Victory of democracy is marked by a flag representing the traditional Croatian coat of arms.

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HAVE YOU DRIVEN A FORD LATELY?

Ford

By Doug Stewart

She can size up your old building in a heartbeat

You never know when Carolyn Pitts may drop by town in her constant search for places from our past to nominate for landmark status

Taking a break during a look around upstate New York, Pitts talks shop with architect Bill Shelgren.

Unannounced and uninvited, Ford Weiskittel inches his car up a long private driveway overgrown with trees on the outskirts of Geneva, New York. Craning his neck over the steering wheel, he peers up through the incipient wilderness to catch a glimpse of his destination.

"It has a name: Ashcroft!" he says excitedly. Beside him sits Carolyn Pitts, a federal official who's come from Washington to look at old houses. Pitts is peering up through the trees, too, but without the evident enthusiasm of her guide. She sees a lot of old houses.

Weiskittel, a classics scholar and member of the local historical society, says he tried to buy the place a dozen years ago. "I didn't have much money, so I was looking at rundown properties." The owner wouldn't sell, and he hasn't been inside since, he warns her.

Through the foliage of an enormous copper beech, a once-grand Gothic Revival cottage appears, tangled in wisteria vines. A sawed-off tree trunk props up the roof of the rotting front porch. Pitts, an architectural historian for the National Park Service who scours the 50 states looking for architectural landmarks, is impressed despite the estate's air of genteel decay. "My, my, my," she says quietly, standing below the steeply angled gables. "This is high style. Look at those verge boards. This must have been quite a sumptuous place."

Ashcroft is Janice and Roland St. Louis' 1862 Gothic Revival house in Geneva, New York; it caught Pitts' eye.

Janice St. Louis interrupts her ironing to give her unexpected guests a tour. The house is clearly in fragile condition, inside and out: the ceiling leaks, the walls are fissured. Bats have moved in. A night nurse at a nearby hospital, St. Louis spends what free time she has trying to keep the elements at bay, but, she says soberly, "It's like trying to move a sand dune with a tablespoon." The effort, she adds only half-jokingly, has killed half the male members of her family. As if on cue, her husband, Roland, emerges from the rear of the house holding a caulking gun. "We've got bathroom problems," he says by way of greeting.

Janice, whose family has owned the house since 1942, reports that it's listed on the National Register of Historic Places. "It was built in 1862, and it's a Calvert Vaux design."

"Oh, really?" Carolyn Pitts' ears twitch almost visibly. Calvert Vaux was Frederick Law Olmsted's longtime colleague and a major figure in American landscape architecture. "It was his own little private project that he did just before he started Central Park," Janice says.

Thanking her hosts for their hospitality, Pitts muses about Ashcroft's likely fate on the ride back to town. "It's going to fall apart," she says grimly. An estimate of $200,000 cited by the St. Louises just to fix up the exterior strikes her as low. "Well, I might take a swat at it," she says. "Not because it's got the integrity it should but because there ought to be an effort to do something about this house. It *is* an important building. Maybe we can finesse it."

Photographs by Paula Lerner

Sizing up the old place in a heartbeat

Merrill Roenke jr. oversees Rose Hill in Geneva, New York, a Greek Revival mansion dating from 1838.

When Carolyn Pitts talks about "taking a swat" at something, she's not referring to hitting it with a wrecking ball. She's talking about nominating it to become a National Historic Landmark. For the past 30 years, landmarking has been part of a government effort not only to commemorate the glories of the past but also to identify and preserve a three-dimensional historical record of where we've been as a nation, how we've lived and what we've created. In the architectural domain, landmark status is to a building what an Oscar is to a movie. The ultimate decision about what becomes a landmark is solely that of the Secretary of the Interior; Pitts' job is to nominate buildings around the country, big or small, public or private, pedigreed or homemade, that merit the Secretary's consideration on architectural grounds. "Where George Washington slept—forget it," she growls. "I'm not into that."

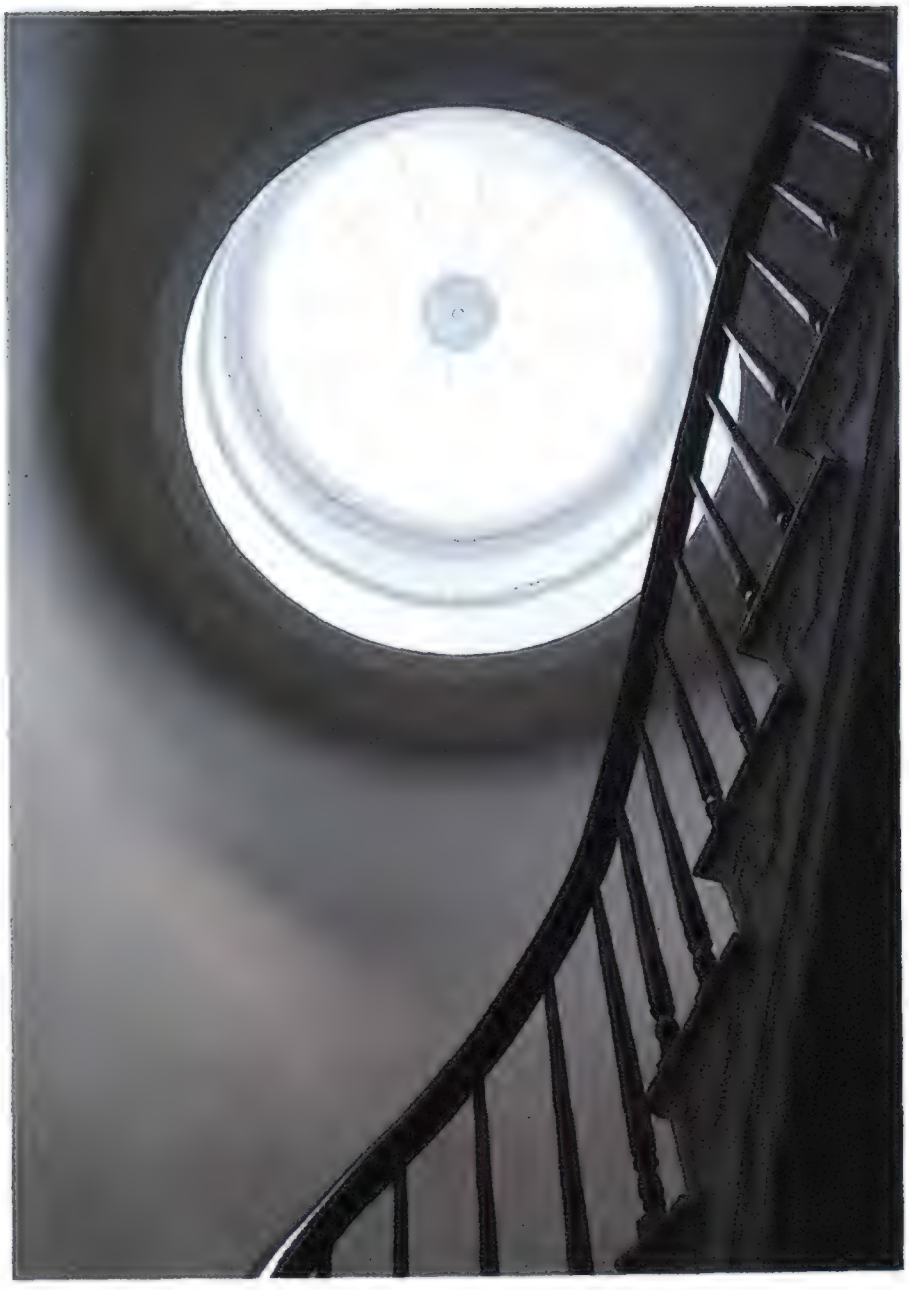
(Architectural significance is only one criterion for which a property may become a landmark. Pitts' eight colleagues in the landmarks program focus on sites that have historical, scientific or cultural significance, or that honor a notable person or event. The nation's 2,000-odd National Historic Landmarks include battlefields, tugboats, carousels, the million-acre King Ranch in Texas, the X-10 nuclear reactor in Oak Ridge, Tennessee, Gerald Ford's suburban Virginia home during his pre-White House years, and many, many buildings where George Washington slept. Most of the buildings that Pitts recommends have already been named to the National Register of Historic Places, the "master roll" of 60,000 sites around the country that were carefully documented and then nominated by individual states. In other words, if the National Register is the "long list," the Landmark program is the more select "short list.")

Among preservationists, Pitts is legendary for both her acumen and her toughness. "Carolyn's a powerhouse," says David Sellin, a former curator of the U.S. Capitol who sits on a committee that reviews all her nominations. "She goes about her work in her own gruff manner, and she's always right on target." Says another admirer on the committee, Don Klima of the Advisory Council on Historic Preservation: "I, for one, wouldn't want to go toe to toe with Carolyn in a debate over architecture. If she stands behind a nomination, that's good enough for me."

Pitts has come to Geneva and a nearby town, Cazenovia, not because of any particular architectural treasures but rather because large portions of these towns, tranquil villages in New York's Finger Lakes region, are unspoiled remnants of 19th-century America. Then as now, both were cultured, moderately prosperous communities that drew college students, well-to-do retirees and summer residents. If present-day Geneva, in particular, passes muster in Pitts' eyes, she plans to nominate an entire chunk of town as a National Historic Landmark.

Helping her in her task, Ford Weiskittel creeps

Though well-funded when named a landmark in 1986, the house has benefited from increase in visibility.



Some 10,000 visitors a year climb Rose Hill's recessed spiral staircase; woodwork and skylight are original.

down street after street at ten miles an hour. He pulls over every block or so with the comment, "Let me show you my favorite house." Frowning thoughtfully, Pitts casts a studied eye at Federal mansions, Italianate villas and a surprising number of 19th-century adobe homes. Weiskittel insists he hasn't planned his route to avoid streets jammed with split-level ranches.

Low-interest loans arranged by the Geneva Historical Society have paid for much of the fixing up. Preservation takes manpower as well as money, however. Merrill Roenke, the well-connected 77-year-old curator of Rose Hill, a regal 1838 Greek Revival "farmhouse" on the far side of Seneca Lake, has enlisted the local judiciary in the cause. First-time drunk drivers are apt to find themselves rebuilding shutters under Roenke's supervision.

After writing this story, regular contributor Doug Stewart has shelved any plans for sheathing his 1840 New England home with vinyl siding.

Unlike Rose Hill, which received landmark status in 1986 after Pitts nominated it, not all the old houses in Geneva have been restored; some are borderline derelicts. Weiskittel invariably notes which are for sale. "Make an offer, Carolyn!" he says outside one colonnaded but dilapidated house. Pitts is taken with how much of old Geneva remains intact. "This is like a movie set of the kind of town where people used to grow up," she murmurs as she passes block after sylvan block of restored Victorian cottages. "You've got everything from mid-19th century and a little before, all the way through to 1915 or so, whenever this town died." (Death, to an architectural historian, is a relatively benign term. Bursts of economic prosperity are typically accompanied by binges of demolition and new construction. Largely lacking in 20th-century industry, little Geneva was spared these convulsions.) "And it hasn't gotten all yuppied up," she says approvingly. "How many candle shops can one town have?"

Carolyn Pitts is not a spritely woman—at 68, she

Once billed as the "Eighth Wonder of the World," the West Baden Springs Hotel in Indiana, with its enormous domed lobby, faces an uncertain future even though it was awarded landmark status in 1986.

suffers from sore knees—but she thrives on poking her head into odd buildings all day long. "This is what I enjoy," she says as she climbs laboriously back into Weiskittel's car after admiring an 1853 octagon. "I get all pumped up on the road." Her periodic whirlwind scouting trips compensate for the fluorescent-lit, form-filled bureaucrat's life she leads back in Washington.

Not that she's a compulsive tourist who reads display-case labels addictively. The bane of her existence is the unabridged house tour, especially when the house in question is architecturally undistinguished, and most especially when the tour guide is a hovering, landmark-coveting owner. "Oh, good, a tour group," she'll say in a gravelly stage whisper as a bus pulls up to a house museum. "We can sneak in."

By virtue of her job, Pitts has to be judicious and mostly tight-lipped when she visits sites. The local preservationists on whom she depends tend to be eager

During the past year, local and state preservation groups have stepped up efforts to save the 1901 site.

and enthusiastic, though never outwardly importuning. Pitts, for her part, doesn't gush. "Oh, my, an estate and a half," she says lightly as she rides past a sprawling mansion. "Ooo, that's very nice" is her only comment as she passes through a neighborhood of ornate Gothic Revival cottages. A simple "Grrrrr" suffices when she enters a house that has been heedlessly remodeled.

To an outsider, Pitts' job might seem akin to that of a perpetual homebuyer, operating on instinct and waiting to fall in love with the right house. Nothing could be farther from the truth. She is, in her own words, "unsentimental" about the properties she visits and evaluates. Her job as an architectural authority is to be a judge, not a cheerleader.

Yet it involves a balancing act. Historic preservation is an activist's enterprise. It's a long-running battle against the territorial imperatives of the "tear-'em-downums," as Pitts refers to real estate speculators and their political allies. It's a fight against civic inertia as well. Preservationists battle one another, often fiercely, about the proper uses of the past. But most share a common belief: that a nation's social fabric is the poorer when the achievements of past generations survive only in museums and on bookshelves.

A manner equally gruff and witty

In the service of this overall cause, Pitts is anything but coolly academic. She uses her job as a bully pulpit. At an evening meeting of the Geneva Historical Society, at which she's the guest of honor, she gives advice and offers encouragement to the audience before, during and following her after-dinner slide show (p. 134). Her manner is equal parts gruff and witty. She ends her talk with a raspy-voiced exhortation: "If you don't know how these programs work, go over and talk to the people in your state preservation office. State and federal people work for *you*. A lot of them don't know it, but they do."

Pitts is constantly reminding people that preservation is at heart a local activity; it can't be mandated from Washington. Her druthers to the contrary, landmark status is chiefly an honorary designation. It places almost no restrictions on a privately owned building. The day after you get your bronze plaque, you're free to call in the bulldozers—provided you don't use federal funds in doing so. ("That's why I'm rarely welcomed on a university campus," Pitts says. "Colleges depend on federal money, and they don't want any strings attached if they want to tear a building down.") Rules that spell out what colors people can paint their houses and how much they can be fined for altering their front-door fan lights are invariably local ordinances, not federal laws.

As a preservation tool, landmarking used to have more clout. In the 1950s and '60s, two well-intentioned federal campaigns—slum clearance, known euphemistically as "urban renewal," and Interstate Highway building—were chewing up the man-made landscape. As a result, the feds were Public Enemy No. 1 in the view of the fledgling historic preservation movement. With popular backing, the National Historic Landmark program, which got rolling in the early '60s, and the broader National Register of Historic Places

Farrell Grehan

In the Victorian seaside resort town of Cape May, New Jersey, Carolyn Pitts nearly got in over her head. Then a private consultant, she led a bitter, eventually successful preservation fight in the 1960s and '70s.

indisputably saved many important buildings from being flattened in the name of progress. Today, the most tangible benefit of federal listings is that they can help property owners win tax breaks and state grants, although there is less of either than there once was.

Historic preservation, once viewed as the pastime of dilettantes, is now often likened to trench warfare: protracted, bitter and no holds barred. Pitts learned this firsthand when, as a private consultant, she led the fight to protect a huge ensemble of Victorian summer cottages and boarding houses in Cape May, New Jersey, in the 1960s and early '70s. Many of the storm-battered buildings were poised for demolition with urban-renewal money. A number of them, she discovered, were major works by leading architects of the day (SMITHSONIAN, September 1978).

"It got pretty thick for a while," she recalls. Her Philadelphia apartment was broken into twice, she says. "Nothing was taken, but there were Cape May papers all over the place." And twice she had an electrician come to disconnect phone taps. Ultimately, Pitts engineered the placing of the whole town on the National Register of Historic Places in 1969 without tipping off the local city fathers, who, she says, considered the old buildings "trash." The pols learned of her victory when they read about the designation in the newspapers. Thereafter, local support swung to the preservationists' side. Seven years later, Cape May became a National Historic Landmark. Since 1981, Secretaries of the Interior have chosen not to designate buildings or districts as landmarks unless owners consent unanimously to the honor.

"I hadn't realized what I was getting into," Pitts says of the Battle of Cape May. "I was messing up their real estate game. That's one reason I'm feisty. Once you get your back up against that kind of wall, there isn't much else that's going to intimidate you."

Pitts, a single woman who started out as a painter and later taught art and architectural history, signed on as the architectural historian within the National Park Service's history division in 1974. (The NPS's role as overseer of historic landmarks is an awkward adjunct to its job as custodian of national parklands. "The Parkies," says Pitts, "think people like me are sissies.") Right away, she was shocked to learn of an unwritten rule that architectural landmarks be added more or less chronologically. "That was an ungodly slow way of doing things," she says. "They'd only reached the Greek Revival. I decided that Rome could disappear while they were fiddling with Greece."

She nominated a slew of skyscrapers—the nation's "one great contribution to world architecture," in her considered view. Prominent among these was New York City's Chrysler Building, although nominating it vio-

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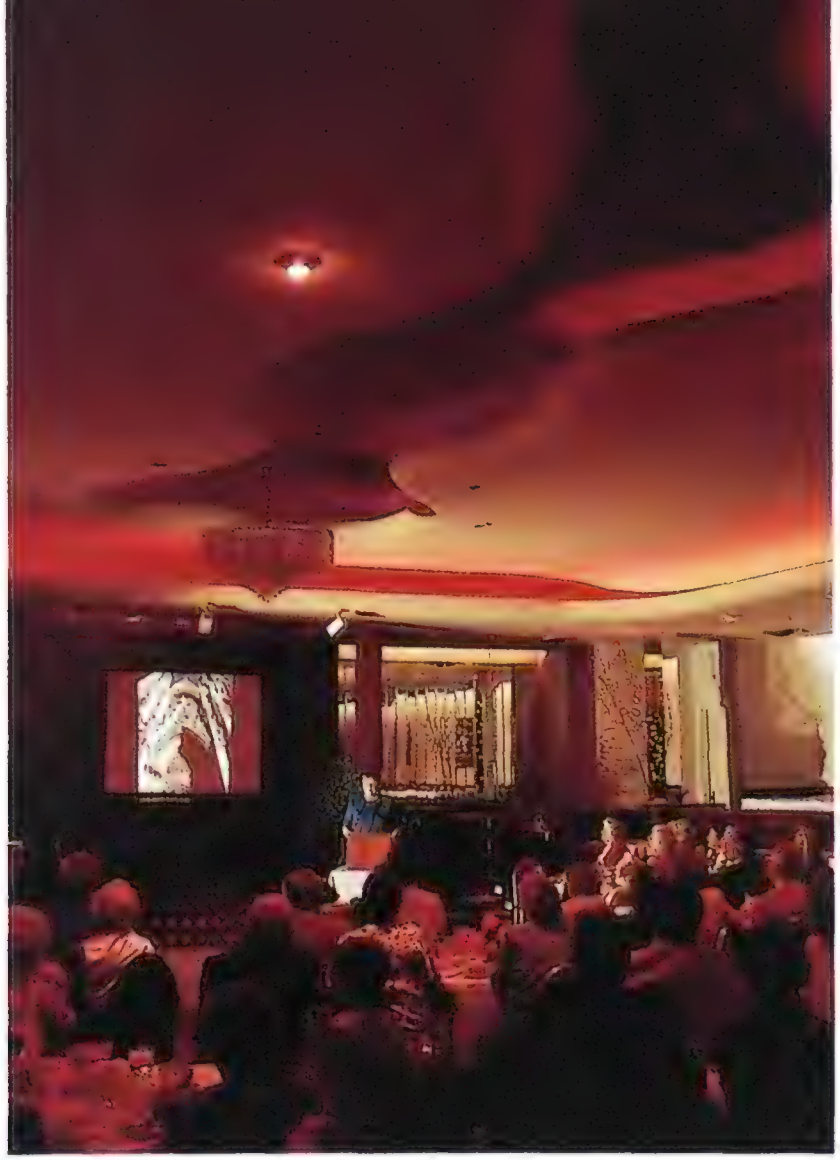

A popular dinner guest when she's on the road, Pitts gives Geneva Historical Society folks her pep talk.

lated a second rule: that buildings be at least 50 years old. The Chrysler was 48. "That's the regulation," says Pitts, "but as far as I'm concerned, regulations don't mean beans if you know something has a place."

If the East Coast today has traditionally been, in her words, the "beating heart of the preservation movement," the Midwest has been slower to embrace the old-is-better ethic. Not long after her upstate New York trip, Pitts heads for Indiana for five days of site visits and troop-rallying, stopping in at rehabilitated schools, riverfront mansions and the odd Art Deco church. Her chauffeur and schedule-keeper for much of her cross-state marathon is Marsh Davis, a staffer from the Historic Landmarks Foundation of Indiana. Davis sticks to the two-lane back roads, pointing out his favorite unpainted farmhouses and the occasional stone chicken coop. When he has to veer onto Interstate 65 for a spell to keep Pitts' hectic schedule on track, he apologizes.

Outside the tiny hamlet of Lancaster, chickens run for cover as Davis pulls up to an austere stone building perched in dramatic solitude on a grassy, windswept hilltop (p. 137). Built by abolitionists in 1849 and known as Eleutherian College, this was the first college in the country founded expressly so that females and blacks, some of them former slaves, could study side by side with white males. Pitts thinks the Greek Revival structure may have landmark potential on both historical and architectural grounds. Now empty, following years as an elementary school, the still-imposing edifice was recently bought at auction for the price of a used car by two members of the historical society in Madison, the county seat. Dotti Reindollar and Jae Breitweiser are waiting eagerly in front of the massive stone portico as Pitts and Marsh drive up.

Inside, the ambience is that of an old-time meeting hall (p. 136). Sunlight streams in through immense side windows. An upright piano shares a wall with an ancient wood stove. A balcony runs along the rear of the room. Tattered and dusty though it is, the hall's stark interior whisks its visitors straight back to antebellum Indiana. Pitts admits she feels moved just standing here.

The two nervous owners announce they're hoping to turn the building into a museum that could host large meetings and festivals. They ask for advice. "Do we restore it accurately?" Breitweiser asks. "They wouldn't have had running water in 1849. Or electricity." Her friend wonders aloud if outhouses would do. Clearly, their vision of how they're going to use the building hasn't quite jelled.

Davis cautiously ventures up into the belfry to ring the college's original bell, navigating gaping holes in the flooring to do so. Pitts shows no interest in joining him and instead sits at a card table in the main room. The table is buried in old documents, 50-year-old newspaper clippings, and government forms for getting the building onto the National Register. "We read just enough of the forms to say, 'Oh, my!'" Breitweiser says.

"Don't dawdle . . . I'll call you in one week"

"They're not as bad as they look," says Pitts. With her two hosts hovering on either side, she leads them through the forms. Once Eleutherian College is "legit," she explains, they'll be eligible for whatever money the state can afford to dole out. Money is something that will be needed in large quantities just to keep the building intact. "And don't dawdle." Reindollar turns to her partner: "You heard that."

"I'll call you in one week," Pitts says as she gets up to leave. "If you haven't done it, you're in trouble."

The two women are energized. Few people have ever looked so thrilled at the prospect of filling out government forms. On the ride out, Pitts smiles. "Those are wonderful, crazy women, both of them. They just might pull it off."

The raison d'être, quite literally, for Pitts' trip to Indiana is a state preservation conference at the town of French Lick—her department's travel budget is meager, so Pitts agreed to give the keynote address in exchange for airfare. Cultivating her spy network at

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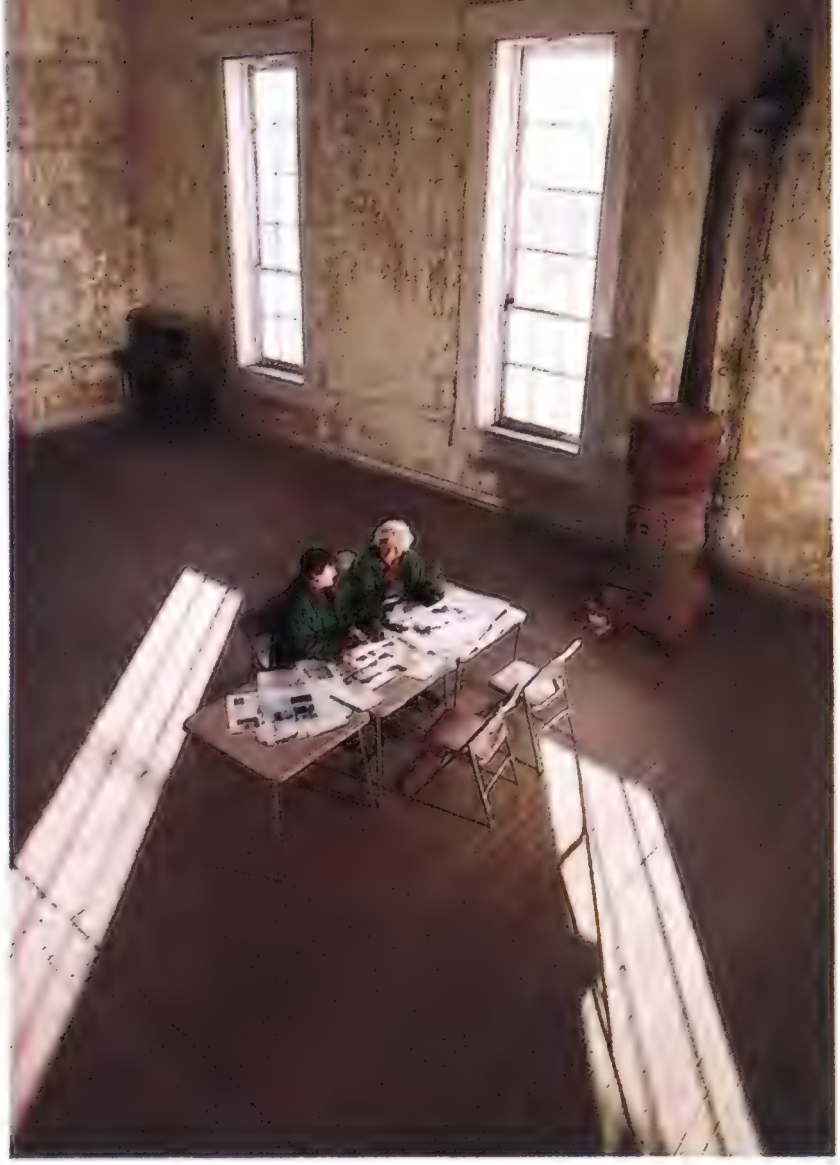

Jae Breitweiser and Dotti Reindollar, Eleutherian College's new owners, ponder the building's paperwork.

the conference, she hobnobs with local activists and state officials, congratulates new grant recipients and laughs at old preservationist jokes. (How many preservationists does it take to change a light bulb? Four—one to change the bulb, one to document the event, and two to lament the passing of the old bulb.)

On an afternoon sidetrip, Pitts and the other conferencegoers tour the nearby West Baden Springs Hotel, a onetime "Eighth Wonder of the World," now deserted and surrounded by woods and overgrown fields. Back when a dozen trains passed daily through town, a gambling mecca, the 1901 spa boasted hip-roofed outdoor bath pavilions, a two-tiered racetrack (bicycles above, ponies below), an opera house, and sunken gardens planted with rare species from Europe and Asia. Its crowning glory is a 200-foot rotunda, covered by what local researchers believe to have been the largest self-supporting dome in the country until the Houston Astrodome was built. The empty hotel became a landmark in 1987. She worries that the deteriorating pleasure dome, now languishing in receivership, may have to be "defrocked."

Inside, the vast space is still undeniably breathtaking, but vandalism and neglect have left it a shambles. "It was gorgeous. The floor was all mosaic," says a woman from a nearby town as she wanders inside the rotunda, her voice reverberating under the dome. "It makes you sick to see it this way. I don't see how they can ever bring it back." A developer from upstate wonders if a revival of gambling, this time legal, could save the hotel. "Can you imagine wandering out onto these balconies and looking down on the gaming tables?"

"Sounds great," says Pitts unenthusiastically. "I hope you have a bottomless pit of money." She stares at the skylit dome, the peeling columns, the dusty floor where dinner for 1,200 used to be served. She's still impressed. "It's really crazy what Disney spends creating ersatz things," she mutters, "when they could spend that money restoring something like this."

The crux of preservation isn't pickling a building in a jar, as Pitts well knows. It's finding a new (and profitable) use for an old building, yet leaving intact its historical flavor. Spiffing up a timeworn mansion is easy compared with turning a prison into offices, or a torpedo factory into an arts center.

Or a cotton mill into a dinner theater. At the conference, Pitts meets a shy young builder named Charles Martin who, for the price of a *new* car, has just bought one of her recent landmarks, the little-known Cannelton Mills. Empty but structurally sound, the sprawling sandstone masterpiece was built on the Ohio River in 1849 in an attempt to bring the cotton mills closer to the cotton. Martin bought it almost on a whim. "I just fell in love with it," he tells Pitts in a soft Kentucky drawl. "I don't care much for fancy homes, but this was a place for working folks." He talks of opening a dinner theater inside featuring Civil War reenactments to help pay for the mill's restoration.

"They've got to take this guy under their wings," Pitts says later, gesturing toward the assembled pros. "He doesn't know what he's got." She makes a point of introducing him around, and that night she talks up the mill's architectural beauty in her banquet-hall speech and coaxes Martin to take a reluctant bow. Afterward she says, "Now we'll see if Mr. Martin is a hero. Maybe he is."

Pitts' concerns for her architectural finds obviously don't end when the plaques go up. She wants to see them survive and thrive so that people will admire them, use them and learn from them in future centuries. Among her many landmarks, those she treasures most aren't the grand, gussied-up manor houses. They're the unsung buildings like Cannelton Mills—forgotten gems in faded neighborhoods. "I love hearing people say, 'I live five blocks from that, and I never knew it was worth anything.' Whenever I hear that, I put two notches in my rifle."

Can Eleutherian College be saved? Yes, if its owners—with a little help from Carolyn Pitts—have their way.

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By Bruce Watson

For a while, the Luddites had a smashing success

In 1811, desperate English weavers made a name for themselves by trying to destroy machines that destroyed their livelihood

On a cold April night in England's Midlands, a band of defiant and determined men took up arms against the most relentless foe in history. Their enemy held no territory. It had no weapons or soldiers. It had no battle plans. But if these troops gave the slightest ground, the invader would sweep over them, stealing their food, their children, their livelihood.

All day, word spread throughout the rolling, green valleys between Leeds and Manchester. Whispers passed through mills and pubs, among anxious folks on muddy streets, down quaint country lanes that gave no hint of the desperation behind closed doors. With a wink of an eye, strangers recognized another secret soldier. With a hush, they gave the word: the General requires our services. Meet at the Dumb Steeple near on midnight. Bring a weapon. Here's a musket ball, a pint of gunpowder. If you know a lad you can trust, bring him to the St. Crispin Inn and old John Baines'll see he's "twisted-in." Cartwright's mill is armed to the teeth, rumor has it. There'll be trouble, all right. But by the soul of Ned Ludd, this enemy must be stopped.

Approaching midnight, more than 200 men gather in an open field. Some wear masks. Others blacken their faces. Disguised in coats turned inside out, checkered shirts and smocks, they pass a bottle of rum around to bolster their spirits. On command they line up. The musketmen, ten abreast, go first. Then the pistoleers. Hammer and hatchet men fill the third ranks, while a gang armed with pikes, hedge stakes, bludgeons and bare arms brings up the rear. Silently moving down into the sleeping valley, they march toward a battle that, in some sense, has never ended from that day to this. The year is 1812. Their target: technology.

In the late 20th century, an uneasy truce prevails between man and machine. Modern workers, riffling through arcane instruction manuals and cursing at last-minute breakdowns, may well dream of smashing a computer to bits—or bytes. Yet somehow, coaxing hardware and software, we get the job done. But the men who marched through the Spen Valley that night in 1812 stood eyeball-to-eyeball with technology, and they did not blink. Machines offered them no Faustian bargain, only repetitive labor at best, at worst unemployment, hunger and ruin for their families. These first soldiers in the struggle against machines have been nearly forgotten in our headlong rush toward a high-tech future. They are remembered in name only—the Luddites. According to *Webster's*: "**Luddite** *n* 1: A member of any of various bands of workers in England

Cartooned General Ludd is disguised as woman because many Luddites tried to hide identities from militia.

By 1830s what Luddites feared most had come to pass—textile mills needing only a few unskilled workers.

(1811-16) who destroyed industrial machinery in the belief that its use diminished employment 2: Any opponent of new technologies or technological change."

The word, now bandied about the office among enemies of the microprocessor and its offspring, was once a call to arms. Between 1811 and 1816, to be a Luddite in England's textile district was to stand for humanity, craftsmanship, and a way of life as endangered by the Industrial Revolution as any dinosaur by ice age or meteor. A Luddite was a brother, a father, a son and a secret. A Luddite was a cropper, a weaver, a hero and a soldier loyal to General Ludd. Eventually, up against the largest force of British troops ever before assembled to put down local rebellion, the Luddites steadily waged an uncompromising guerrilla war.

"We will never lay down Arms [till] The House of Commons passes an Act to put down all Machinery hurtful to Commonality, and repeal that to hang Frame Breakers. . . . We petition no more—that won't do—fighting must." To the mill owner who received this threat signed "General of the Army of Redressers, Ned Ludd, Clerk," the army needed no introduction. By the end of 1811, Luddite bands were smashing machines throughout England's Midlands. But who was this Ned Ludd? According to legend, the lad who gave his name to a movement was never a Luddite himself. Ned Ludd (or Lud or Ludlam) was a mere apprentice knitter in England's wool district during the 1770s. Ordered by his father to get on with his work, Ludd rose up in a fury, took a hammer and smashed his knitting frame into a heap of broken parts. Adolescent temper had fired a shot heard round the textile district, a shot that would be remembered when the machines came to the Midlands.

In the early 19th century the world's most advanced technology was the steam engine, which had already propelled Fulton's steamboat in America and set power looms to weaving in England's new cotton mills. It was a

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Luddites wanted to preserve both the cottage industry of the past, as shown here, and the tradition of handwork done by experienced craftsmen.

time when, with no help from the machine, human genius and megalomania had put their stamp on the world. Beethoven, Goethe, Wordsworth, Austen, Goya and Napoleon were at work.

England's moors seemed quiet, but in 1811 word came to London that workers in the Midlands were up to some mischief. The first decade of the 19th century was hard on the land. Bad harvests cut grain supplies and tripled prices. The British were on the verge of war with Napoleon and America. Parliament cut off trade with both, leaving nearly half the wool industry unemployed. But the handwriting that spelled doom for skilled textile workers was written on the largest wall anyone had seen in the Midlands, the factory wall.

Angry workers had invaded shops, taken the jack-wires from knitting machines, broken a few others. In March a crowd of men trooped from Nottingham to nearby villages. They were armed with swords, pistols, hatchets and blacksmith's hammers. Though they looked like a mob, their actions were anything but chaotic. Entering small shops, a few smashed stocking frames to bits while others stood guard at the door. They harmed no one, just the frames that made cheaper stockings with less-skilled labor.

Similar attacks followed. Rumor said the men called themselves "Ludds," "Ludders" or "Luddites," and legends spread about the heroes who dared to say no to the machines that stole their jobs. In pubs and homes, magistrates' questions met silence. Ned Ludd? Never heard of such a lad. *General* Ludd? You must be daft, guv'ner. By April 1811, more than 200 frames lay broken across Nottinghamshire. When a local militia and yeoman cavalry assembled in the region, the secret army lay low for the summer.

These days there are neo-Luddites among us. They complain that words should not be "processed," want phones answered by warm-blooded receptionists and insist that no matter how small a computer becomes, there's

Neo-Luddite Bruce Watson regards technology with awe and suspicion.

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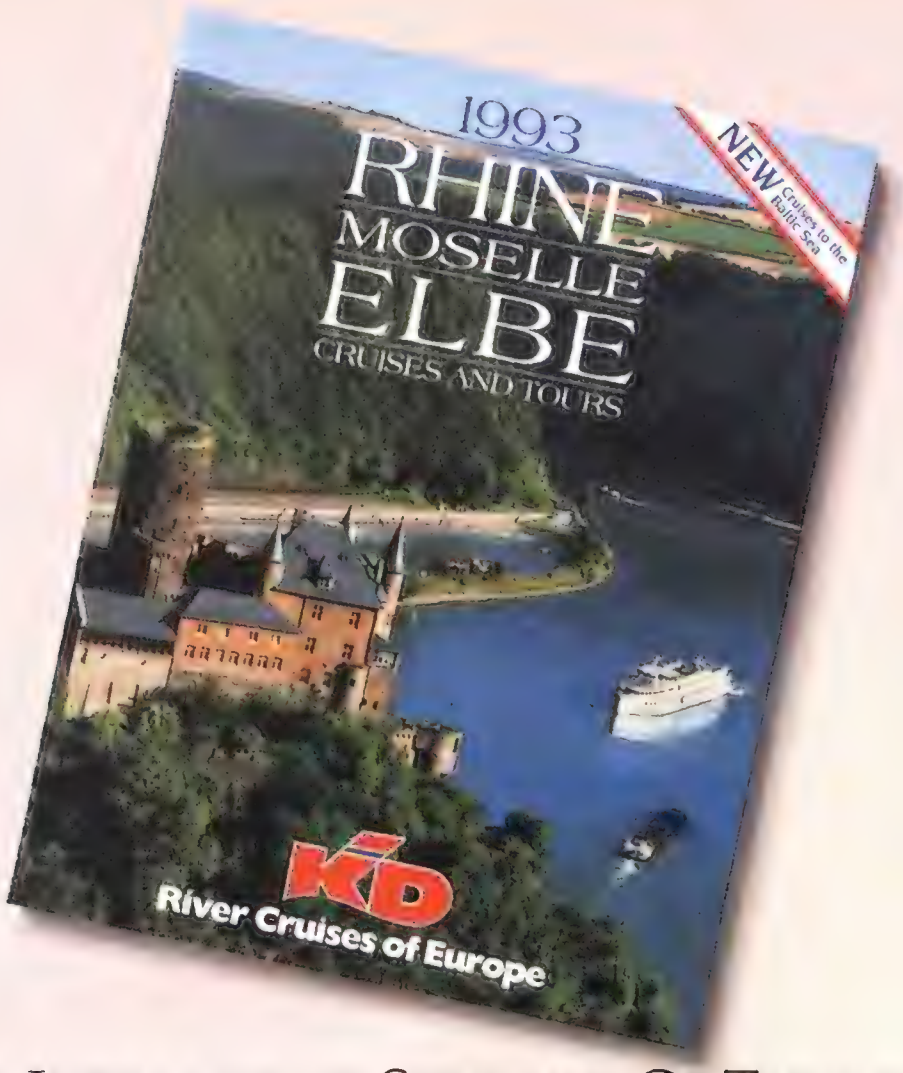

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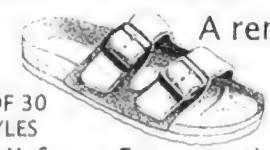

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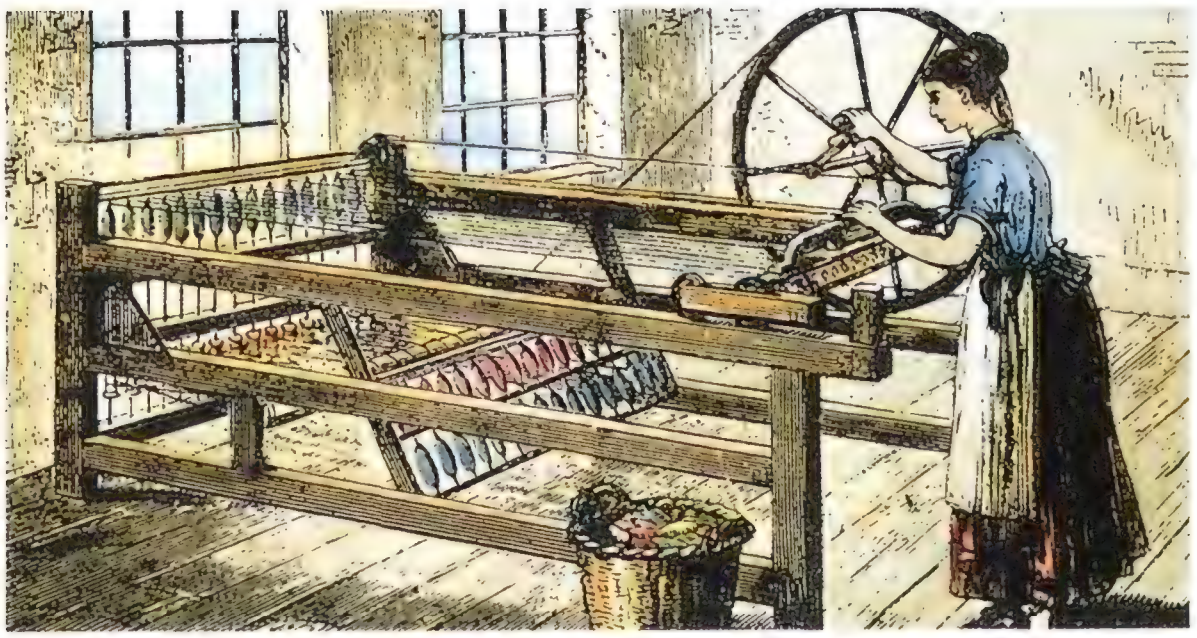
As owner protests and child cowers, Luddites smash hated spinning jenny.

nothing "personal" about it. Neo-Luddites like to think the original machine-haters shared their techno-nightmares. But England's Luddites expressed their philosophy in threats alone, and their motives were simple. They were hungry. They were unemployed. Although a comet hung over the green hills of England's woolen district in September 1811, they did not have to look into the sky for omens. Their craft was unraveling like a poorly woven cloth.

"I have five children and a wife, the children all under 8 years of age," one poor weaver told a local magistrate. "I get 9d. clear (per week). . . . I work sixteen hours a day to get that. . . . It will take 2d. per week coals, 1d. per week candles. My family live on potatoes chiefly and we have one pint of milk per day."

Before 1750, England's textile district had been a craftsman's paradise where wool was king, weavers princes and machines unwelcome. There were pre-Luddites, among them true royalty. As early as 1552 Edward VI banned a simple gig mill, which sheared wool; later, his sister, Elizabeth I, all but outlawed production of a stocking loom. "I have too much love for my poor people who obtain their bread by the employment of knitting," the queen said, "to give my



Spinning jennies improved after invention by James Hargreaves in 1760s. This one turned 60 spindles at once, was used for wool, cotton or flax.

money to forward an invention that will tend to their ruin." In 1675, weavers destroyed looms that could weave as much as 20 men. In 1768 sawyers tried to demolish a mechanical sawmill.

It was a question of craftsmanship. Wool shorn from sheep in yonder fields and flax grown locally were spun at home by women, the wool woven on hand looms in small mills or workshops, stretched on frames, "teasled" with wire brushes to ruffle the texture, and finally sheared by hefty men called croppers. In the West Riding district of Yorkshire alone, there were more than 3,000 croppers proudly bearing the marks of their trade, huge forearms from wielding the 50-pound shears, and crescent-shaped calluses on their right wrists where the shear handles repeatedly scraped the skin.

But while America and France fought bloody political revolutions, England was in the progressive throes of the Industrial Revolution. In only 40 years, beginning around 1740, English inventors created the spinning jenny, the boring mill and a screw-cutting lathe. Crucible steel became commercially viable, the first iron rails were cast, and James Watt's steam engine was fired up for the first time. When those cunning catalysts Progress and Profit teamed up, no king, queen or law could stop them.

By the 1790s, factory bells rang through the textile district, tolling for cottage industries. Never mind that construction of the first cotton mills drew menacing, angry crowds. It was a question of simple arithmetic and sheer efficiency. By hand, it took one man 88 hours to finish the same amount of cloth that a machine could shear in 18. Other machines—wider looms, broader frames to make stockings out of pieces instead of whole cloth—used steam power and unskilled labor to spin wool into money.

By the early 1800s manufacturers were ignoring the law and mechanizing the wool trade. Outraged by the shoddy machine work that threatened their centuries-old craft, between 1803 and 1806 workers raised the astonishing amount of £10,000 to lobby for enforcement of antimachine laws. To no avail. In 1809 Parliament repealed all laws regulating the wool industry—including those prohibiting the use of machines. Defenseless against steam-driven progress, men remembered Ned Ludd and prepared to fight. No one could say the mill owners were not warned: "Wee Hear in Formed that you got Shear in me sheens and if you Dont Pull them Down in a Forght Nights Time Wee will pull

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them Down for you Wee will you Damd infernold Dog."

After that the Luddites rose in full force. In early November 1811, a workers' army led by a man calling himself "Ned Lud" marched to a workshop in Bulwell. Axes and hammers smashed the door. Shots came from the windows. Luddites fired back. A wave of attackers retreated into the darkness, regrouped, charged and entered. A few jumped the owner and stood over him while others moved through the workshop smashing frames. The job done, they gathered outside and took roll. One man was missing. The war against technology had its first casualty, John Westley, a Luddite killed by gunfire.

Vowing vengeance, the army scattered into the night. New Luddites were recruited, swearing themselves to silence and learning a tangled set of signals for spotting other followers of General (or sometimes King) Ludd. In a crowd, a Luddite raised his right hand over his right eye. If another Luddite was present, he raised his left hand over his left eye. Following other hand gestures, coded questions were exchanged. Soon, Luddite regiments carrying sticks and guns were marching in fields while a rich lore of songs and poems spread throughout the Midlands, traveling by word of mouth. People sang of "the Atchievements of General Ludd" and compared him to Robin Hood.

All that winter Luddites were a secret by day and a scourge by night. Each morning, mill owners tallied the damage: "Seven frames broken at Holbrook, eighteen at Pentrich." Requests for protection brought only a few dozen troops. The British Government, preoccupied with arming Wellington against Napoleon's forces in Spain and Portugal, dismissed the machine breakers as idle mobs, and the Luddites hammered technology with an ease that today's machine haters can only envy: "Nine frames broken at Basford, two at Bulwell." Then in January 1812, with attacks occurring

every night, 3,000 troops marched north into the Midlands. With soldiers advancing, the poor rioting in the streets for bread, and armies of the night bludgeoning machines, the whole region had the "appearance of a state of war," as the London *Times* declared.

In February, Parliament debated making frame breaking punishable by death. A vast majority approved, but rising to the defense of the Luddites was a rather good-looking young chap making his first speech in the House of Lords. Having visited the Midlands, Lord Byron had seen the hunger. "However we may rejoice in any improvement in the arts which may be beneficial to mankind," he wrote a fellow peer, "we must not allow mankind to be sacrificed to improvements in Mechanism." Some have said that Byron was just a rebel in search of a cause, but in defense of the Luddites he was both eloquent and romantic.

"All the cities you have taken," he declared, "all the armies that have retreated before your leaders, are but paltry subjects of self-congratulation if your land divides against itself, and your dragoons and executioners must be let loose against your fellow citizens." Byron proposed that frame breaking be punished by mere im-

Rawfold's Mill in Yorkshire barely withstood a strong Luddite attack.

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prisonment, but his amendment was summarily rejected by the House of Commons. Only a week later, he published *Childe Harold's Pilgrimage*, a narrative full of wit and adventure that became one of the best-sellers of the age. The poet was soon lost in his celebrity, and frame breaking became a capital offense. Actually catching a frame breaker was another matter. Soldiers learned what local constables knew—that any Luddite was a prophet with great honor in his own county. No matter how many people had seen Luddites marching, heard whispers or had one in the family, their whereabouts and strategy were kept close to the heart. Meanwhile the threats and violence escalated.

By April 1812 every small town had its own band of Luddites, and the machine breakers were ready to attack their most hated foes. In the Colne Valley, mill owner William Horsfall had boasted that he would ride "up to his saddle girths in Luddite blood." At nearby Rawfolds Mill, William Cartwright, defying all threats, had relentlessly mechanized and fortified the place. Its iron-studded front door hid stairs laced with 16-inch metal spikes, a large vat of sulfuric acid to pour onto attackers, and armed guards sleeping inside. A bell on the roof was ready to call troopers from nearby barracks. More fortress than mill, Rawfolds was ready.

In a room above a pub, according to local lore, croppers and weavers, some as young as 16, met to decide on their target. Ultimately, they spun a shilling. Heads, Cartwright; tails, Horsfall. It came up heads.

The night of April 11 was especially cold. In a field near the Dumb Steeple, less than a mile from Robin Hood's grave, more than 300 Luddites gathered. Marching north along the packhorse tracks on Hartshead Moor, then past the home of Patrick Brontë, whose daughter Charlotte would later describe the Rawfolds attack in her novel *Shirley*, they went quietly so as not to arouse the sleeping regiments

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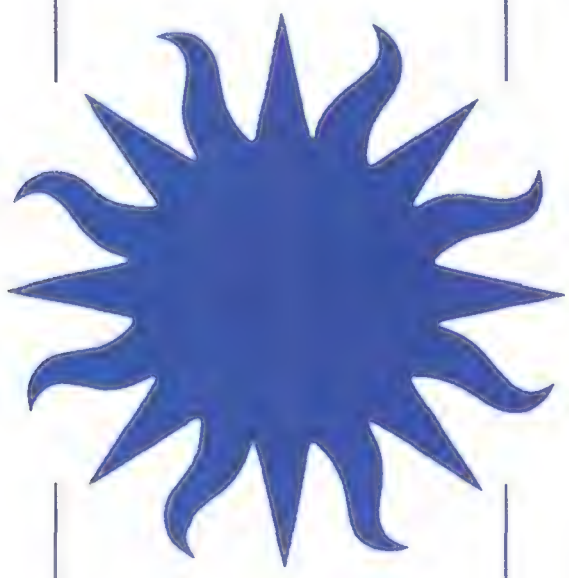

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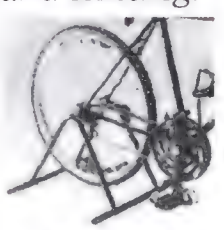

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quartered nearby. Other Luddites from nearby Leeds failed to show at their appointed meeting place, but the army, too eager to turn back, pressed on until it came to the mill on the Spen River. Two men jumped the guards outside and gagged them. "Hatchet men, advance!" came the order. In regimental formation, men approached the mill. Inside, a barking dog awoke Cartwright. When he opened the door of his makeshift bedroom, musket fire shattered the ground-floor windows, and sledgehammers hit the door.

Cartwright frantically passed out muskets. In their nightshirts, his men began firing down on the attackers, all except one who refused to shoot lest he hit his brother. On the roof, the bell pealed. Within minutes, the attackers broke all but 9 of the mill's 300 windows. But the front door wouldn't budge and the repeated clanging of the bell promised that regiments of the king's soldiers would be arriving any second. Luddite leaders struggled to keep their company together. Sledgehammers pounded the door and smashed holes in it but couldn't get it open. After 20 minutes General Ludd's troops fell back. Some helped the wounded back to safety. Others just bolted. Rawfolds had held.

When the toll was taken inside, only Cartwright had been wounded. But outside, two Luddites lay dying, and no one knew how many others were hit. Following the battle, food riots and machine breaking spread across the whole region. "Vengeance for the blood of the innocent" was scrawled on cottage doors. In marketplaces and town squares, outnumbered magistrates read the Riot Act and filled the jails. British officials hired spies to infiltrate Luddite meetings. Paid for their stories, informers fed the government's worst fears with wild exaggeration: 10,000 Luddite supporters and 30,000 guns ready for shipment from Ireland; huge caches of weapons. Anonymous letters to the Home Secretary predicted a nationwide Luddite

After Luddites had called for his assassination, Prime Minister Spencer Perceval was shot. The gunman proved to be insane—and not a Luddite.

uprising. Behind this specter of mass revolt was a single general. Or was he?

His name crossed valleys and hills. It was posted on public notices, whispered in back rooms. A few threats were signed by Lady Ludd, Eliza Ludd or King Ludd, but most bore the imprimatur of the general himself. Street urchins taunted passing soldiers, shouting "I'm General Ludd!" Magistrates questioned informers, but no matter where they looked, they could not find the leader of the Luddites.

Throughout the insurgency, General Ludd's poems and songs made it clear that machines, not men, were his target: "The guilty may fear but no vengeance he aims/At the honest man's life or Estate,/His wrath is entirely confined to wide frames/And to those that old prices abate." But with the machines so well defended, Luddites began to wage their war by other means. Night raiders stole weapons for future battles. A factory and the owner's house were torched. Just after Rawfolds, William Horsfall rode up to his saddle girths not in Luddite blood but in his own, shot to death by Luddites.

On May 9, 1812, a paper was posted in Nottingham, calling for the death of Spencer Perceval, the British Prime Minister. Two days later, Perceval was assassinated by a lone gunman while entering the lobby of the House of Commons. Cheers, bonfires and celebrations swept the Midlands. Though the assassin turned out to be a deranged avenger with no ties to the Luddites, the lack of a conspiracy did not calm British officials, who had seen enough of insurrection in France and their former colonies in North America. Was a revolution brewing in the Midlands?

An unwritten law of human nature says that change, to be accepted, must come incrementally. Creeping mechanization—a better mousetrap here, a more efficient whirligig there—disturbs only the true technophobes. The rest of us just buy the machines we think we'll need, learn the basics and try not to lose the warranties. But whenever a barrage of machines swiftly shoves a society from agriculture to-

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ward industry or from industry toward information, the forces of opposition rally.

In the late 20th century a sea of troubling technology sweeps through the workplaces and marketplaces. All at once, it seems, everything that used to have a dial becomes digital, and everything once done face-to-face is "interfaced." Fax machines, computers, laser printers, voice mail, E-mail, cordless phones, cellular phones, camcorders, CD players, and extended families of compact, portable and personal devices raise questions about the uses of technology and make doubters out of dutiful workers.

Political theorist Langdon Winner writes: "Rapidly evolving technologies would seem to provide us an occasion to pause and take stock, to ask . . . which factors ought to guide our choices about technology?" Writer Wendell Berry raises a dilemma implicit in the Luddite uprising: "Is the obsolescence of human beings now our social goal? One would conclude so from our attitude toward work, especially the manual work necessary to the long-term preservation of the land, and from our rush toward mechanization, automation, and computerization."

Reviving the old tradition, neo-Luddites arise. Only a few, however, seek open confrontation, most notably members of the environmental group Earth First!, who disable bulldozers and logging equipment (SMITHSONIAN, April 1990). It is perhaps just as well. Before taking up arms, any aspiring neo-Luddite should consider the fate of his or her eponymous ancestors.

For in the summer of 1812, General Ludd met his match, another British general, one Thomas Maitland. Before taking command of British troops in the Midlands, Maitland had put down uprisings in India and the West Indies. Having also helped French royalists battle a bunch of rowdy Parisian citizens in 1789, the stern Scot knew revolution when he saw it. This was no revolution, he concluded. This was starvation.

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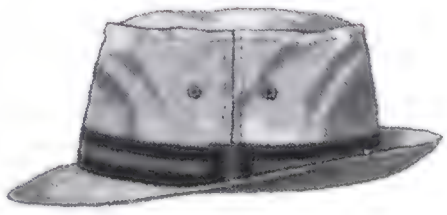

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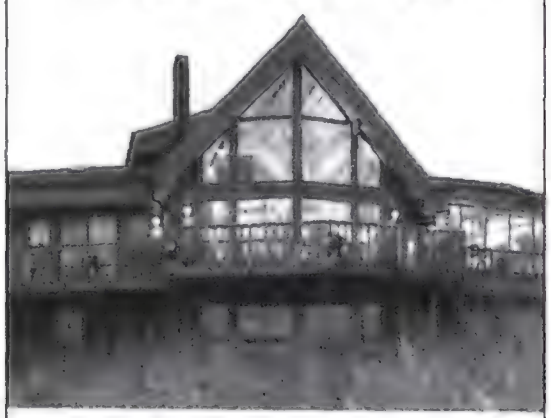

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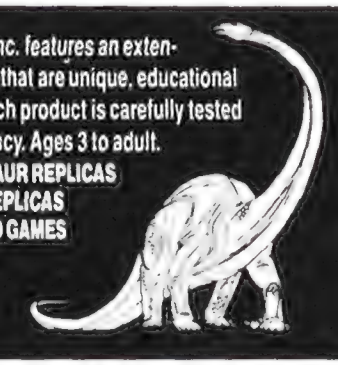

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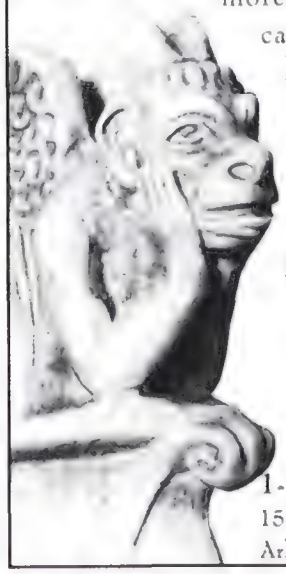

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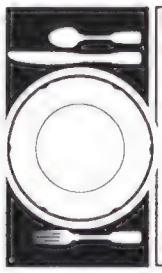

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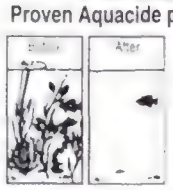

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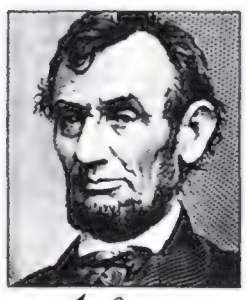

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Moving into the embattled region, Maitland's army entered a world as distant from London as a common weaver's life was from an aristocrat's. In the Manchester markets, a penny that bought three pounds of potatoes the year before now bought only one. Among those sentenced to hang was an old woman who had stolen potatoes, then jumped on a butter cart and sold its contents to a hungry crowd. Into this situation marched 7,000 men, 1,400 of them mounted, joining the 5,800 already there. Local militia brought the total to 35,000, more than Wellington had taken with him in 1808 to fight in Portugal.

Maitland's tactics were as simple as "divide and conquer." In widely circulated fliers, he guaranteed pardons to those who renounced their oaths to General Ludd, offered cash money to informers and waged a campaign of intimidation. "Fear, and fear alone" would conquer the Luddites, Maitland decided. All summer, it was the weapon of choice.

Troops began chasing Luddites at night, breaking up meetings, taking prisoners and extracting confessions in closed rooms, which one captain wryly described as "dancing school." Hundreds of Luddites turned themselves in. Others gave evidence against their leaders. As Maitland had suspected, there was no General Ludd. Angry Ned Ludd's name had been taken up by the leader of each regional army. Hunger and desperation alone had united the Luddites.

In September, following weeks of sporadic midnight raids, an anonymous letter gave Maitland whole lists of pubs where Luddites met. Arrests brought more information, and soon all the Luddite leaders were in custody. "I think General Ludd has left this neighbourhood," a constable wrote his commanding officer in October. "We are very quiet only I often get a delightful letter threatening to blow out my brains."

The cry now was "Blood for Blood Says General Ludd," but despite such

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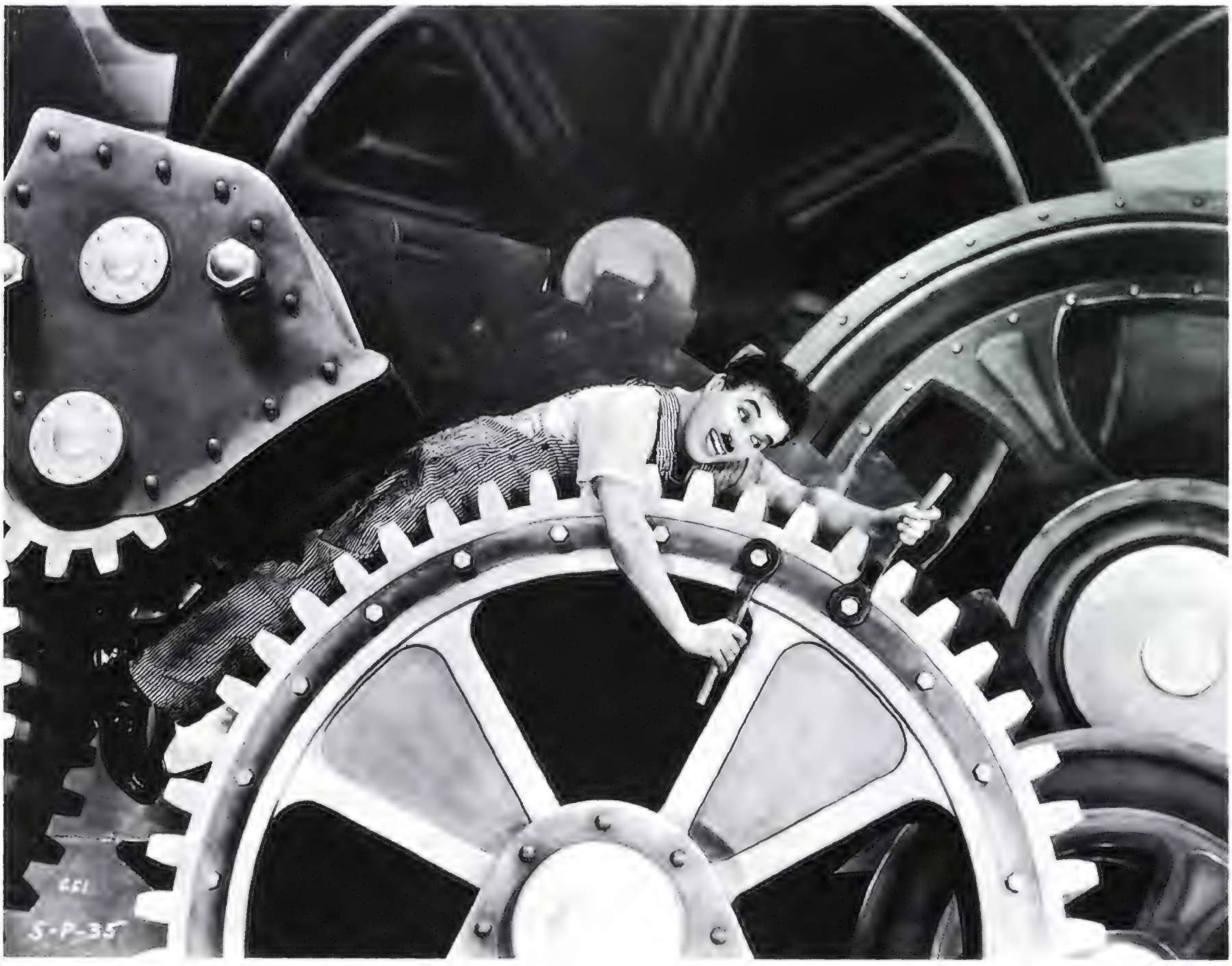
threats against judge and jury, justice was swift. In York 17 Luddites were hanged, 7 acquitted, the rest imprisoned or exiled. And so it went.

While today's Luddites proudly recall their predecessors, the name has a pejorative meaning. Novelist Tom Clancy, whose technothrillers make a high priest out of high tech, pinned the name on opponents of President Ronald Reagan's Strategic Defense Initiative. Any teacher who was suspicious of computers in the classroom quickly earned the label. Central to the anti-Luddite argument is the notion that machines create jobs and make life better.

Perhaps. But for the crushed Luddites themselves, machines brought no golden future. Having lost a war against technology, they lost the peace as well. By 1817, nearly 1,500 shearing machines were doing a cropper's job in Yorkshire alone, and by the time thousands of croppers petitioned Parliament for help, more than three-quarters of them were unemployed. Their craft had simply disappeared. The Luddites had always feared the worst, but the eventual squalor of the factories and mills could only be described by a writer of consummate skill, Charles Dickens, who was born during the Luddite uprising.

Periodic machine breaking continued. In 1830, threshing machines were smashed by followers of a mythical "Captain Swing," and whenever recession laid off workers, a few gig mills were hammered. In Midlands villages, the midnight meetings, drills and incendiary rhetoric continued off and on for 40 years. Old machine breakers kept their oaths of secrecy and sang Luddite songs to their grandchildren. But the men who wielded the first blows against technology passed on, leaving only their name and spirit to inspire those who wonder if humanity is the master of its machines—or vice versa.

Like Charlie Chaplin in this gripping scene from 1936 film *Modern Times*, neo-Luddites feel victimized by technology, but are less bellicose than followers of General Ludd.



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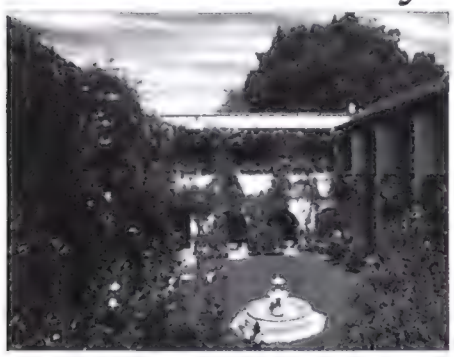

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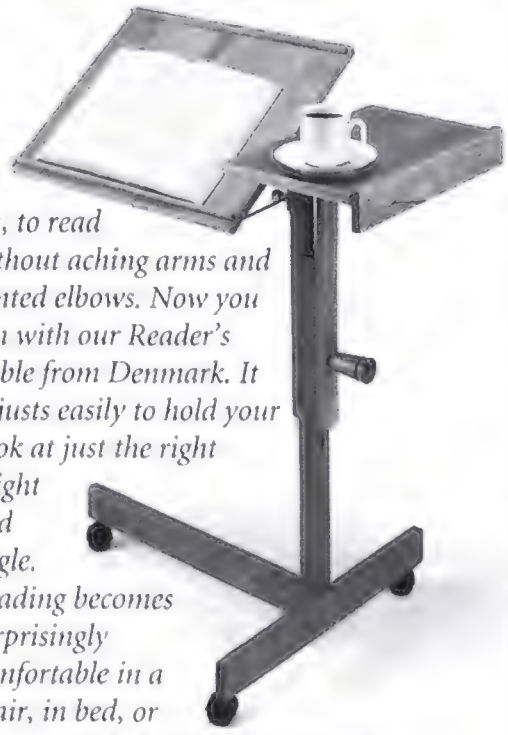

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Book reviews

Anthony Trollope
Victoria Glendinning
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It has been 111 years since Anthony Trollope died. He was immensely popular in his day, and he is immensely popular now. "Never before, even in his lifetime," writes Victoria Glendinning in her splendid new biography of the novelist, "have Trollope's books been so well published, so readily available, or so much in demand." And yet Trollope's reputation is still being formed.

Trollope is widely read and widely revered, but he is also that rare first-class novelist who somehow makes the reader feel indulgent toward him. The one thing everyone knows about Trollope is this: he was exceptionally businesslike about his writing, which depended more on good work habits than on inspiration. "To me," he wrote in his *Autobiography*, "it would not be more absurd if the shoemaker were to wait for inspiration, or the tallow-chandler for the divine moment of melting." Trollope's good work habits made him prolific, so much so that when I was a graduate student of English literature in the late 1970s, reading all of Trollope was regarded by my young colleagues as something of a parlor trick.

Some novelists seem to belong to their readers. Dickens, riotously popular as he was, did not. Nor, of course, did Jane Austen, though in her essential character as a novelist she is much closer to Trollope than Dickens was. About Dickens there was a kind of untempered genius that made him seem like a different order of being than his audience. (Trollope said of Dickens that he "taught himself to be his own God, and to believe himself to be a sufficient God for all who

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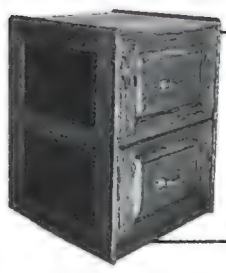

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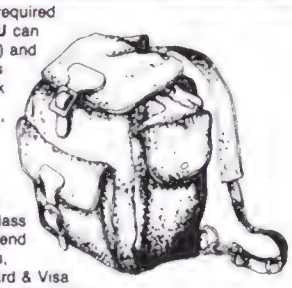

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came near him.") But Trollope has always belonged to his readers. He speaks to us directly, openly, about life, his characters, the way his novels are unfolding.

There is something amusing–and perhaps, to some, a little ridiculous–about the sheer number of Trollope's books (he wrote 47 novels), as if with each new book he grew fatter and less serious and more, rather than less, like us. Trollope never used art as an excuse or as a cudgel. His stories are plain, and when he writes, said Henry James, "he is seated on the back of heavy-footed prose."

The very qualities that make Trollope distinctive–the abundance, the familiarity, the ease of his work, as well as his self-deprecating remarks about his manner of writing–also make his reputation rather hard to judge. He is one of the greatest English novelists of the 19th century, that greatest of novelistic eras, but think about Henry James' opening remark in his review of *Miss Mackenzie* (1865): "We have long entertained for Mr. Trollope a partiality of which we have yet been somewhat ashamed." Who was ever ashamed of partiality for the novels of George Eliot? The fact is that we are used to thinking most highly of writers, such as Eliot, who in one way or another conquer us, who make us feel their power, their difference from us.

But Trollope doesn't triumph, and there is nothing Olympian about him. *The Warden, Barchester Towers, Framley Parsonage, Phineas Finn, The Way We Live Now*–in each of these wonderful novels the author is a reassuring presence, welcoming us, showing us around, making us feel so much at home that we somehow lose sight of what a remarkable creation we've become a part of. It's odd, but Trollope makes us feel that his novel would be quite incomplete without us. And that feeling blunts awe.

To the pleasures of reading the Barsetshire novels or the Palliser novels, or any of the rest of Trollope's work, I would now add the pleasure of reading Victoria Glendinning's biography of the man. "Pleasure" is the operative word. Glendinning confesses that she has "never been so happy researching and writing any book so much as this one." It shows. She has kept, throughout this biography, Trollope's own example before her–the care with which he tried to understand the human character, his refusal to paint his heroes either black or white, the moral *interest* that one feels permeating his work.

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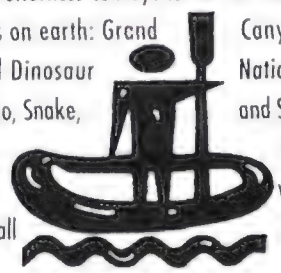

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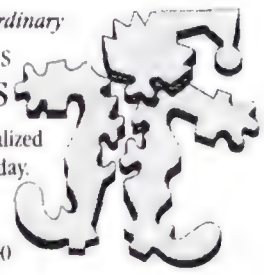

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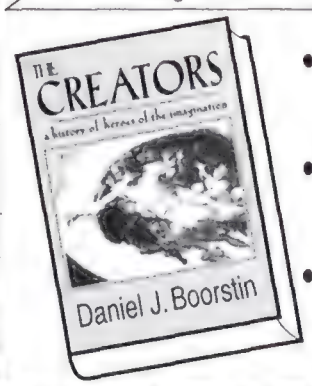

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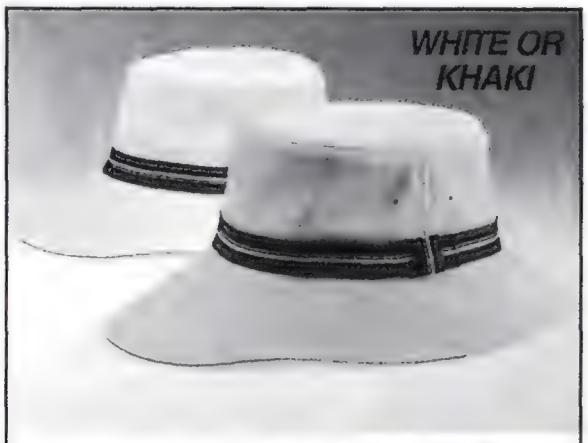

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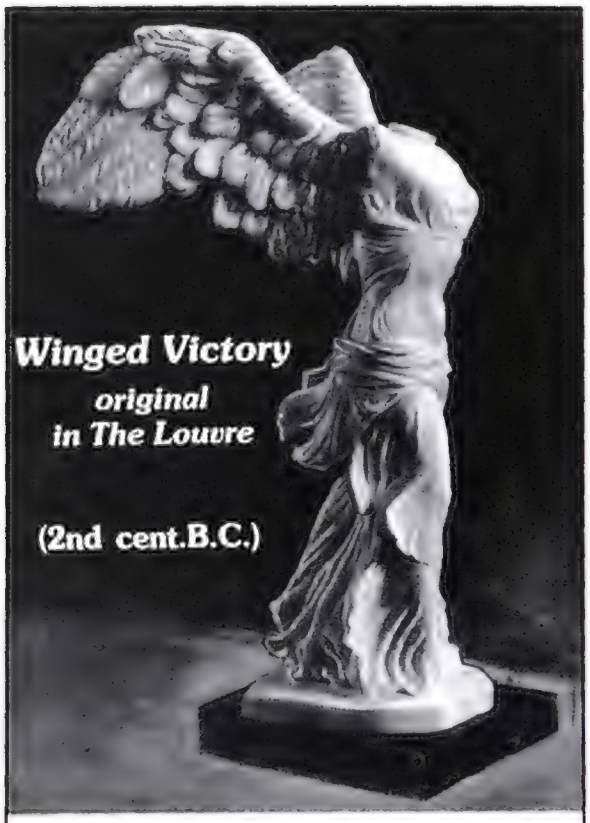

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Anthony Trollope's furrowed brow reflected his myopia, not an ill temper.

Trollope led the kind of life that is almost too easily imagined from the masculine point of view: he was an official in the Post Office, he traveled incessantly, he smoked cigars, he rode passionately to the hounds, he was distinctly clubbable. Glendinning's great virtue, aside from the briskness of her telling, is to see Trollope from the female point of view, to see the aspects of his character that aren't so tobacco-stained, so travel-weary.

She has tried to see the truth of what one contemporary said of Trollope, that "his wife was his books"–that in the domestic comforts of these novels, in the acuity of Trollope's reading of his female characters, you might trace the eye and mind of his spouse of 38 years, Rose Heseltine Trollope. (She is otherwise scarcely visible to history.)

Still, Glendinning's interest in Rose Trollope never becomes a hobbyhorse. It might have, had Rose's husband been a less decent man. But Glendinning is remarkably affectionate toward her true subject, Anthony Trollope, because he deserves affection. His contemporaries tended to remark on his loudness, the way he filled up a room. But there was no pomp, no aggrandizement in that loudness–just exuberance.

What you feel, as you near the end of Trollope's life story, is that he was set apart from his world mainly by an extraordinary amount of energy. Charles Dickens is widely regarded as the paragon of Victorian hyperactivity–a human volcano who burned himself out. Certainly, no writer ever emitted more smoke. But Trollope traveled more wide-

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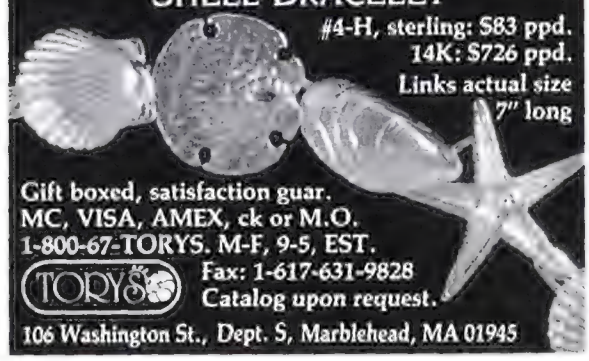

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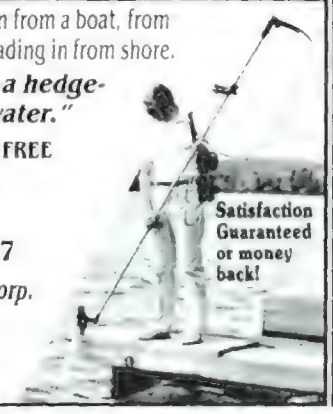

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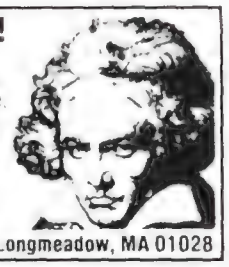

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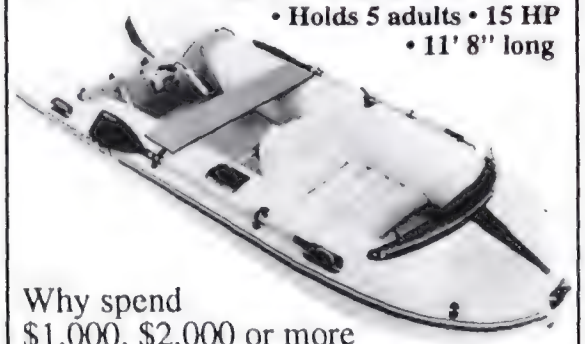

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ly, worked just as hard, dissipated himself less, maintained an utterly separate career in the Post Office for nearly the whole of his writing life, and generally expended himself just as thoroughly as Dickens did.

Trollope's novels were produced according to a constant daily schedule, whereas Dickens seemed to lie dormant and then spew forth a torrent of molten rock. Genius comes in many forms and works according to its own laws. Trollope has done his reputation no good by comparing himself to a cobbler who takes a certain number of stitches before breakfast every day. I think it was meant as a friendly gesture, a bluff, beckoning signal that the writer was an ordinary man. But it's important to remember—and Glendinning reminds us—that as a writer, modesty apart, there was nothing ordinary about Trollope at all.

Verlyn Klinkenborg lives and writes in Housatonic, Massachusetts.

Cities of Gold: A Journey Across the American Southwest in Pursuit of Coronado
Douglas Preston
Simon & Schuster, $25

If you live in a rural village in northern New Mexico, as I do, the names of many of your neighbors are the same as those on the roster of Coronado's army, names brought here by men who arrived as soldiers in 1541 and deserted to stay as settlers when Coronado returned to Mexico the following year. So, as I read Douglas Preston's brilliant account of Coronado's expedition and his own retracing of it, I asked some of these neighbors if they knew who Coronado was.

Not many did. "Oh yeah," one said, "I think that's a football team, the Coronado Tigers." No one who reads Preston's epic narrative will ever have that trouble again. Here is a Coronado not found in the few bloodless paragraphs typical of American schoolbooks, where most of us once met the conquistador, if at all. Indeed, there is not a bloodless paragraph in Preston's book.

By setting out with two companions and six horses to track Coronado's army across a thousand miles of brutal desert and mountain country, from the Mexican border through Arizona into New Mexico, the author was ready to risk his life to try to see with his own eyes, as it were, "that moment, 450 years ago, when the peoples of the Old World and the New World first encountered each other" along this path, and quickly began the

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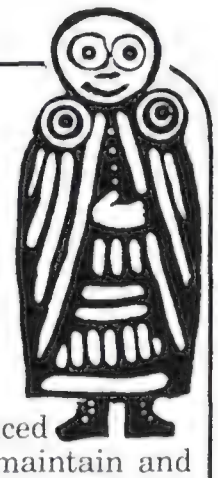

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strife-torn redefining of America. (Preston's initial chronicle of his journey, which was later expanded into *Cities of Gold*, appeared in the January 1990 issue of SMITHSONIAN.)

Throughout the book, Preston intersperses the original reports and memoirs of Coronado's adventure with accounts of his own party's hard progress, making the centuries dissolve into a common first-person, present-tense narrative. And along the way, he records stories of the people and places he encounters, making brief excursions into mining booms and busts, the history of livestock ranching, the impact of barbed wire and windmills, the first mail routes, homesteading, the destruction of Indian nations, current disputes over Forest Service and Bureau of Land Management policies, the role of the environmental movement, and much more.

A book that is so crammed with flashbacks and digressions could become a labor to read, but this one never loses its momentum. The asides add meaning to the story.

In fact, Preston lets the laments of the old-time cowboys and ranchers, and the sad wisdom of Pueblo and Navajo Indians he meets, put the past into a fresh perspective. As he observes at one point, "The great myth of the West is that there had been a winning of it. No, there had been no winning here.... The Indians, the cowboys, the wilderness, the great cattle drives, the unfenced range, the homestead families, all these things have been lost, not won."

Coronado's expedition was inspired by greed, stimulated by the wealth that Spaniards acquired in the conquest of Mexico, and inflamed by tales of seven great cities of gold to the north, told by a Spaniard and an African slave. The Spaniard, Cabeza de Vaca, and the African, Esteban, were survivors of a failed expedition to Florida who had wandered across North America for eight years, mostly on foot, finally arriving in Mexico. Esteban then took a small party, led by a French friar, to locate the cities of gold. Esteban was killed by Indians, but the friar returned to Mexico with claims that the smallest of these cities was larger than Mexico City, and had buildings ten stories high.

It was the friar's imagination that was ten stories high, but his report led to the organization of Coronado's expedition, which departed with 250 horsemen, 70 foot soldiers, 1,300 Indians and blacks,

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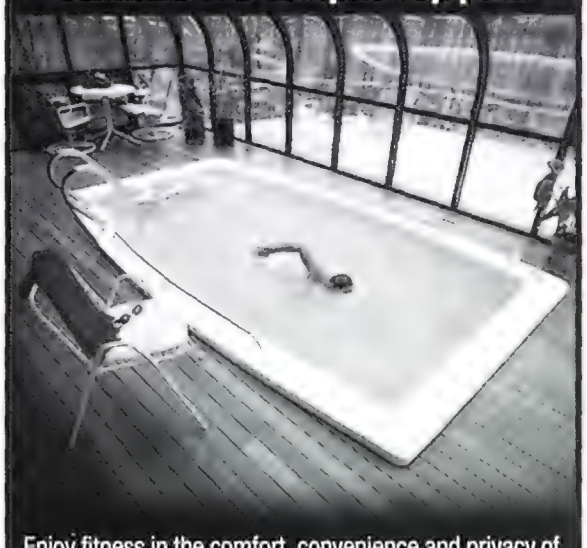

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The Spaniards saw no gold, yet they had met some of the wealthiest people in North America. The Zunis were described by one of Coronado's soldiers: "The land is so fertile that...in one year they harvest enough for seven years." He described how they ground flour, with three stones in one mortar: "Three women come in, each going to her stone. One crushes the maize, the next grinds it, and the third grinds it finer.... While they are grinding, a man sits at the door playing a flageolet, and the women move their stones, keeping time with the music, and all three sing together."

The first encounter between Spaniards and Zunis turned into a battle, beginning the tragic history of domination and decimation of native people throughout the American landscape, a history of greed that has continued devouring its own actors to this day, as real estate developers encroach on the remotest expanses of open space, old family-owned ranches, and even the archaeological remains of one of Coronado's campsites.

Preston's encounters with contemporary members of different tribes along the way, and his use of firsthand reports from the past, create a remarkable portrait of the strength and enduring spirit of native-American cultures. He quotes, for example, an officer who helped incarcerate the Apaches on the San Carlos reservation in the 1870s: "San Carlos won unanimously our designation of it as 'Hell's Forty Acres.' ...Everywhere the...frightened Indian children, darting behind bush or into wickiup at the sight of you. Everywhere the stolid, hopeless, suspicious faces of the older Indians challenging you. You felt the challenge in your very marrow–that unspoken challenge to prove yourself anything else other than one more liar and thief, differing but little from the procession of liars and thieves who had preceded you."

In contrast, there are the words of an old Navajo shepherd Preston met at Ramah, New Mexico. Recalling the horrors of internment of his ancestors at Fort Sumner, another virtual concentration camp, the old shepherd added, "My grandpa, he always warned, 'Never think of the Anglos as an enemy.' He would always say, 'Even though you went through all that hardship don't ever have any-

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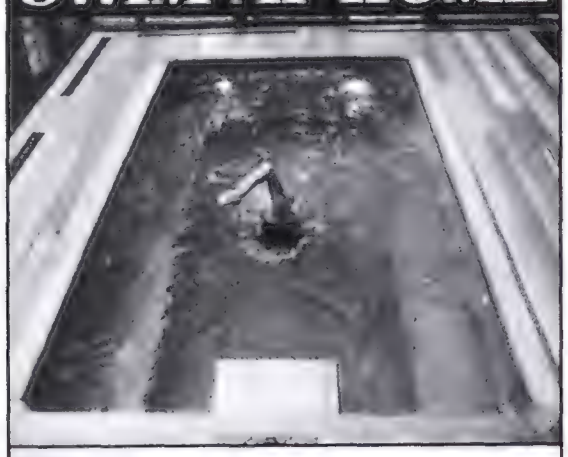

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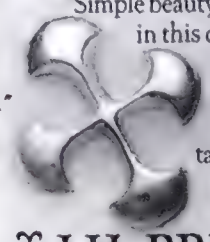

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thing wrong on them, always think of them as yourself.'"

And after a visit and feast at the Santo Domingo Pueblo in New Mexico, Preston records the governor's parting words to him: "The Santo Domingo people have a great tradition of hospitality, which you have seen today. Many centuries ago we greeted Coronado the same way. I hope," he added with a smile, "that you do not return our hospitality the way Coronado did."

The voices of cowboys and ranchers also testify to a way of life that is disappearing. An Arizona ranching couple, Jack and Darlene, speak of their hard times and their children. "My girls," said Darlene, "you'll never find any like 'em. They can brand, they can vaccinate, they can fix fences, they can cut horns, they can help Jack worm–"

"They can saddle their *own* goddamn horses," Jack said.

"They're self-sufficient," Darlene said. "Thank God, they don't *need* a man."

One rancher rages at Forest Service restrictions on land where cattle once grazed, saying, "So it's a wilderness for some son-of-a-bitch from back East to go around and say, 'Oh, isn't this *beautiful*, it's a *wilderness*.' Well, what about us? What about the people who opened up this country?" Another rancher talks about shooting the mountain lions that attack his cattle herds, leading Preston to stop and reflect:

"There was a presumed equality between man and beast: if a lion killed a man's calf, then the man had a right to kill the lion. Only do city and town folk have the privilege to look on nature as benign, since where we come from nature has already been subdued. I wondered how people in New York would feel if a mountain lion moved into Central Park and began killing all their dogs and cats."

Preston further observes that with the end of grazing on public lands, sought by many environmentalists, the likely result would be designated wilderness areas with paved access roads, RV campsites, graded hiking trails and Port-O-San toilets. "Having crossed hundreds of miles of ranches," he writes, "I can say without reservation that most ranchers take better care of their land than 'recreational' users take care of public lands. You never see litter, broken glass, beer cans or ATV tracks on ranches."

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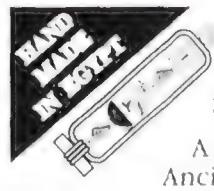

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ton's and his companions' adventure on horseback, in pursuit of Coronado. Battered by the assaults of climate and terrain, almost dazed by the grandeur of the mountains they scaled and deserts they crossed, these greenhorns survived what more-experienced advisers predicted probably would kill them. Although the route took them through towns and beside some highways, much of the way was still as Coronado would have seen it. Seeing a mountainside suddenly liquefy and begin to undulate, with a subsonic vibration, Preston thought it was an earthquake, then slowly realized "that the ridge was carpeted with an immense herd of black-tailed deer," panicked at their approach.

There were many such moments along their route, but near the end a very different vision confronted him as Preston caught sight of a modern city from the edge of a low desert bluff:

"I could hardly believe, looking down on Albuquerque, how much the car had dictated the shape and character of the city; how much it filled the city with loud mechanical sound, poison gas, and mephitic stink; and how much hot shining vulgarity was generated by asphalt, traffic, gas stations, parking lots, and the like. In one great moment of clarity I realized that this invention, the car, more than anything else across history, has forced humankind to remake itself in a new, ugly, machine-like image."

Preston had ridden nearly a thousand miles and five centuries into the past, not always knowing quite why he was doing it. In the end, it was to see us as we are.

Reviewer *Paul Trachtman* is based in rural New Mexico.

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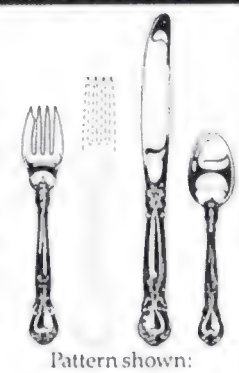

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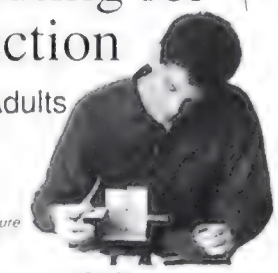

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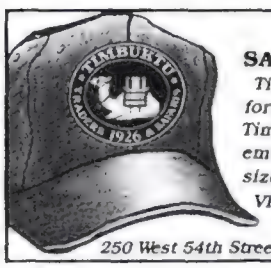

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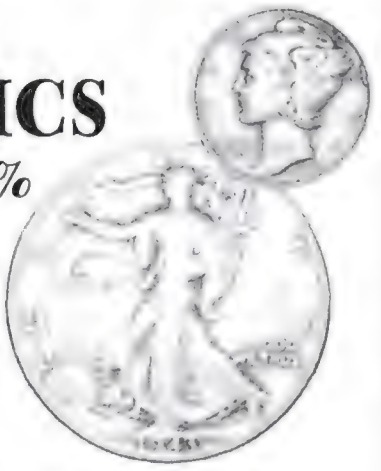

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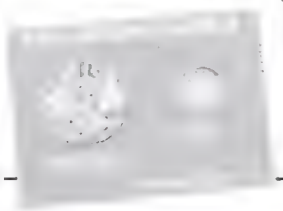

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NEW **Bohemia and Moravia** *June 6-20*

Inside Ireland *June 7-18*

Poland *June 9-22*

NEW **Victorian Holiday: England by Train** *June 17-28*

British Isles Cruise *June 23 - July 7*

NEW **Maritime England** *July 1-13*

NEW **Musical White Nights (Russia and Finland)** *July 3-15*

Iceland Adventure *July 11-24*

Swiss Walks *July 16-29*

Historic Nova Scotia *July 18-29*

Tibetan Journey *July 21- August 7*

Canadian Rockies *July 24 - August 2* Hiking.

Kenya Wildlife *August 3-20*

Amsterdam to Lisbon Cruise *August 4-18*

NEW **Rhine-Mosel Cruise** *August 5-19*

NEW **Swiss Alpine Hike** *August 7-21*

Trans-Siberian Railroad *August 8-22*

NEW **French Canadian Waterways** *August 14 - 28* Cruise on the St. Lawrence River.

Edinburgh Festival *August 16-26*

Switzerland by Train *August 18-30*

Russia's Golden Ring *August 20-31*

Baltic Nations *August 24 - September 6*

French Waterways: Paris to Burgundy *August 27 - September 7*

NEW **Mongolia and China** *August 29 - September 19*

Indonesia *September 1-23*

NEW **Chianti Walks (Italy)** *September 2-14*

DOMESTIC STUDY TOURS

Smithsonian "Anytime" Weekend (Washington, D.C.) From $99 per person, two-night package includes hotel and behind-the-scenes tour. Enjoy lectures and concerts at Smithsonian museums.

NEW **Delta Queen** *May 8-21* Pittsburgh to New Orleans.

Hudson River Historic Homes *May 15-20*

Arches and Canyonlands *May 16-23*

Historic Boston *May 19-23*

Smithsonian Treasures (Washington, D.C.) *May 19-23* For Contributing Members.

Native Cultures of the Southwest *May 23 - June 2 or August 22 - September 1*

Grand Canyon Rafting *May 28 - June 6 or August 20 - 29*

NEW **Accessible Adventures** *June - February* Outdoor programs designed for people with and without disabilities.

Smoky Mountains Hiking *June 5-13*

Alaska's Inside Passage *June 6-19* Cruise on the *World Discoverer.*

Alaskan Landscapes *June 11-22 or July 9-20*

Chicago Architecture *June 16-20*

NEW **Route 66: Scenic Southwest** *June 18-26*

California's National Parks *June 19-26*

Frank Lloyd Wright in Wisconsin *June 20-26*

NEW **Yellowstone Hiking** *June 20-30*

NEW **Massachusetts Heritage** *June 26 - July 4*

THE LATEST WORD ON TOURS, EXPEDITIONS AND

■ TO REQUEST TOUR AND SEMINAR BROCHURES, CALL (202) 357-4700;

■ OR WRITE TO THE SMITHSONIAN ASSOCIATES, MRC 702, WASHINGTON, DC 20560.

Oregon *July 4 - 11* Natural history.

NEW **Beyond the Bering Sea** *July 11 - 21*

Smithsonian Seminars

Discovering the Blues (Chicago) *June 21 - 24*

Paris *June 24 - July 4*

Georgian England *July 10 - 20*

Billy the Kid (New Mexico) *July 27 - 31*

Hawaiian Botany/ Volcanology (Hilo) *August 8 - 12*

Adirondack Ecology (Blue Mountain Lake, New York) *August 8 - 13*

Mackinac Island Heritage (Michigan) *August 23 - 26*

Research Expeditions

Contribute your talent and financial support to Smithsonian research. For information on Research Expeditions only, call: (202) 287-3210 or write Smithsonian Research Expeditions, MRC 933, Washington, D.C. 20560.

Bali, Indonesia *June 2 - 15* Work with anthropologists to document a dance and musical festival.

Washington, D.C. *June 6 - 19* Create a planetarium show for schoolchildren.

Worland, Wyoming *June 19 - July 3 or July 4 - 17* Excavate remains of dinosaurs.

Costa Rica *July 24 - August 5* Monitor an active volcano.

Smithsonian Odyssey Tours

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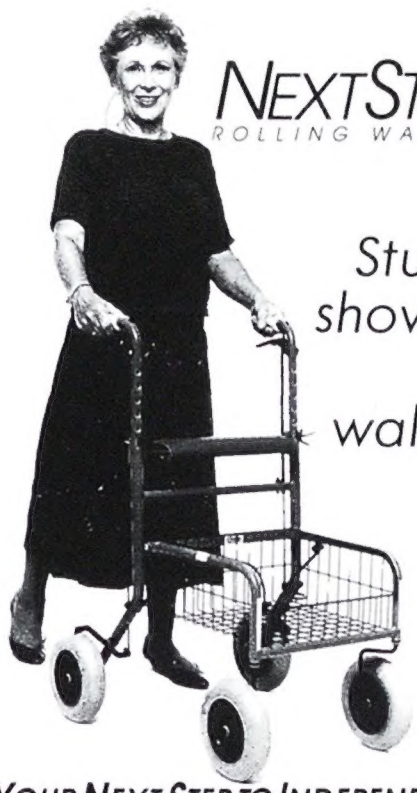

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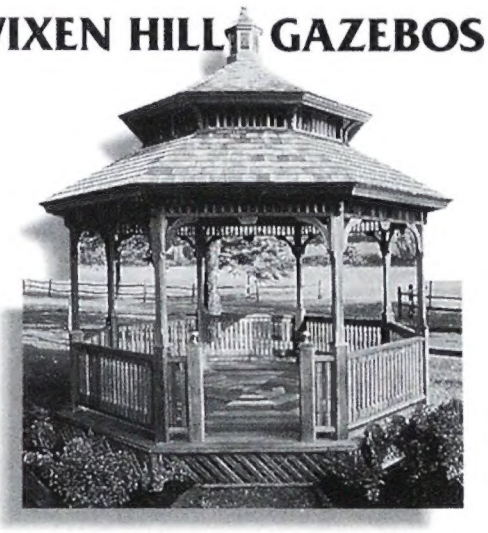

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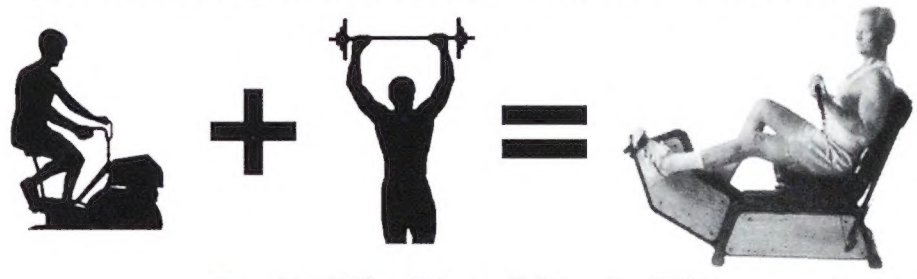

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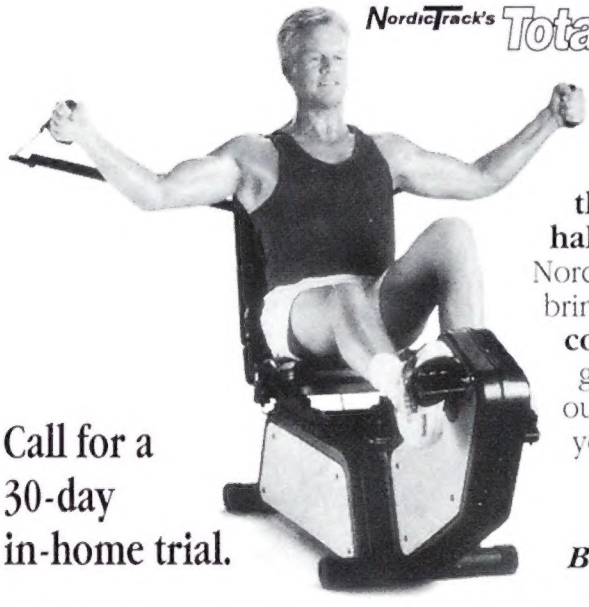

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By Paul Trachtman

The unmaking of a vegetarian—or why I'm full of bologna

I am a recovering vegetarian. The road to recovery is not an easy one, and it was a long while before I could admit that I had a problem. Even after my worst binges—those three- and four-day fruit fasts, or that night when the waiters had to throw me out of the macrobiotic restaurant so they could close and go home—even then I would not acknowledge what was obvious to everyone else, that I was powerless over vegetables.

I denied any connection between my long hours hanging out in health food stores and the drastic changes in my home life. It was about the time I started to cook tofu burgers out on our backyard grill that my son decided to get his own apartment, my marriage broke up and the neighbors began giving me strange looks on the street.

I was hitting the skids. Ordinary vegetables no longer satisfied my cravings. I tried gourmet greens like arugula and began to see weeds as delicacies, sating myself on dandelion shoots and burdock root. I can't say exactly when I bottomed out, but it may have been the day I noticed my skin yellowing—the result of belting down too much carrot juice. It was definitely a shock, a sobering glimpse of myself stumbling down the garden path to oblivion.

It was about this time that a friend confided that he was a member of Vegetarians Anonymous and dragged me to a meeting. One by one the group members told their stories of vegetable abuse and shared their progress along the 12 steps to recovery. Right then, I took the first step. I admitted I was powerless over vegetables, that my life had become unmanageable. That was as far as I got. The other 11 steps to recovery (I won't burden you with the details by listing them) looked to me like a mountain that I would never be able to climb.

It was halfway up a real mountain in the southern Rockies, a year later, that a power greater than myself intervened to restore my sanity. I had drifted away from the city, given up my job and credit cards, and headed West with the deeply ingrained American belief that you can always run from problems and start over again. I soon discovered that there were dandelions and burdock root all over the West, too, often hidden under the ubiquitous sagebrush and cactus. I was drinking sagebrush tea before I knew it. I was eyeing those cactus spines, too, when I ran into a sheep-ranching couple who were about to drive their flock up into the mountains for summer pasture. They invited me along.

After a long, hot morning on horseback, waving my hat and yelling at a thousand sheep, I had begun to get the hang of it. Fortunately the horse knew how to stumble over rockslides, get across creeks and arroyos, and negotiate wooded thickets without much help from me. I just hung on and kept yelling like everyone else.

Finally it was high noon, and the two ranchers, their kids, their shepherds and the dogs all gathered by a frothy mountain stream to rest, while the sheep wandered off to find shade. A big cooler was unpacked on the grass. It was time to eat. I was famished, but I had not thought to bring along my own food. Sandwiches were being made, and there wasn't a tomato or a leaf of lettuce in sight.

All at once there was a young woman with pale blue eyes and a battered cowboy hat holding two slices of soft white bread in her hand. She was looking straight at me and saying, "Bologna or pimento bologna?"

"Pimento bologna!" I heard myself exclaiming, and I felt a flood of memories as she slapped yellow mustard onto meat and handed me the sandwich.

It all came back. Early childhood, when vegetables were always dished out with the threat "eat them or else!" Adolescence, when the only plant considered edible was the potato. The french-fried potato. Marriage, when rice was thrown as a ritual object, like confetti, not served for the feast.

With each bite of my sandwich I felt a sense of self-esteem returning. I'd once had a perfectly normal American appetite, after all.

Now, as I sat beside a mountain stream in the clear air and blazing sun, these memories were like a spiritual awakening. As we all mounted up and started chasing sheep higher into the Rockies, I realized I was waving my hat and yelling—at meat! And I was on the road to eating it, too.

I've stayed on that road ever since, making steady progress one day at a time. The other day I ran into a cowboy friend in town, and he invited me out to his spread the next evening. "We'll just kick back, burn some steaks, listen to the coyotes and watch the sagebrush grow," he said. And we did. A year ago I'd have eaten the sagebrush and tossed the steaks to the coyotes.

But life isn't all meat and potatoes these days. Only recently I took a trip back East and visited my son. To show him how well I was doing, I brought along a quart jar of West Texas barbecue sauce and suggested we put some ribs on the grill for dinner. "Thanks, Dad," he said, "but there's something I have to tell you. I haven't eaten any meat since last week. I'm a vegetarian."

DEWAR'S PROFILE:

Leslie Hindman

HOME:
Chicago, Illinois. "Toddlin' town? Up and running's more like it."

AGE:
37.

PROFESSION:
Founder and president, Leslie Hindman Auctioneers and Salvage One (a source of architectural artifacts).

HOBBY:
Growing orchids. "It's refreshing to work with something that blooms on the surface and not under a million layers of varnish."

LAST BOOK READ:
"Lost in the Funhouse," John Barth.

LATEST ACCOMPLISHMENT:
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WHY I DO WHAT I DO:
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QUOTE:
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